PROJECT
4077.0030

PRE-DESIGN WORK PLAN

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

PREPARED FOR:
ACS RD/RA EXECUTIVE COMMITTEE

PREPARED BY:
MONTGOMERY WATSON

AUGUST 1995

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

This Pre-Design Work Plan was prepared by Montgomery Watson Americas, Inc. (Montgomery Watson) on behalf of certain respondents in response to the Unilateral Administrative Order (UAO) by the United States Environmental Protection Agency (U.S. EPA), Region V on September 30, 1994. The purpose of the Pre-Design is to develop additional data needed to prepare the remedial design for the site remedy. The requirements of the Pre-Design Work Plan are described on pages 18 and 19 of the Statement of Work (SOW) attached to the UAO. The Pre-Design Work Plan addresses the following:

- Permanent fence installation
- Investigation of the wetlands
- Identification of the existing or proposed additional compliance and detection monitoring wells
- Residential well sampling
- In-situ vapor extraction (ISVE) pilot study for buried waste
- Treatability studies for low temperature thermal treatment (LTTT) and in-situ vapor extraction (ISVE) effectiveness on buried waste and contaminated soils

The SOW for the Pre-Design includes excavation and off-site disposal plans for intact buried drums in the On-site Containment Area. The assumed goal of preparation of the intact drum removal plan prior to the preparation of design documents would be to expedite the excavation and off-site disposal intact buried drums. However, test pitting conducted after the RI to collect waste samples for the treatability study indicated no evidence of intact buried drums. Therefore, as discussed previously with U.S. EPA and IDEM, the intact drum excavation plan will be included with the remedial design documents and not included as part of the Pre-Design Work Plan. Drum excavation will take place when treatment of the waste areas begin.

The SOW also requires refining the lead cleanup levels using the biokinetic update model. As discussed with the U.S. EPA and IDEM, this will be conducted and included in the

Performance Standard Verification Plan which is a required component of the Intermediate Design Submittal. This is moved to the Remedial Design because the lead cleanup level has already been established for the site, and the need for modifications to a particular standard, and the potential impact of such modifications, should be considered in the context of the cleanup of the entire site, using the guidance available at that time.

The Work Plan includes a plan for installing a fence around the perimeter of the ACS site to prevent unauthorized access and vandalism at the site. The Work Plan includes provisions for signs to be placed along the fence and at each gate.

Provisions for site investigation/site monitoring are composed of four distinct activities:

- Groundwater contamination extent investigation
- Detection/compliance monitoring program
- Wetlands investigation
- Well abandonment

The groundwater contamination extent investigation is to determine the current extent of groundwater contamination in the Upper Aquifer and Lower Aquifer. After the extent of groundwater contamination is determined, the Detection/Compliance Monitoring Program will be finalized.

The process leading to the final determination of the Upper Aquifer Detection/Compliance Monitoring Program is a series of steps as follows:

1. Inventory Water Level Monitoring Points
2. Propose Additional Water Level Monitoring Points
3. Install Additional Water Level Monitoring Points and Obtain a Round of Water Levels
4. Present Water Level Data (figures and table) to the Agencies along with proposed locations for Tracer investigation sampling points in the Upper Aquifer.
5. Conduct Tracer Investigation in the Upper Aquifer as approved by the Agencies
6. Present results of Tracer Investigation of the Upper Aquifer to the Agencies in a Technical Memorandum, with proposed well locations, as appropriate
7. Install and sample wells as approved by the Agencies
8. Present results to the Agencies with a proposed quarterly monitoring program in a Technical Memorandum
9. Sample wells on a quarterly basis as approved by the Agencies, until less frequent sampling approved by Agencies

It is anticipated that technical staff from the Agencies will be in the field during the contamination extent investigation and that the technical memorandums described above will be collaborative efforts that can be completed and approved without demobilizing from the field.

The Tracer Investigation in the Upper Aquifer will focus on four areas: Wetlands, North of

the Grand Trunk Railroad, vicinity of MW-7, and in the vicinity of well MW-6. In the cases of the Wetlands, North of the Grand Trunk Railroad, and the vicinity of MW-7, the goal of the Tracer Investigation is to locate the edge of the plume (i.e., non-detection of VOCs in the Tracer Investigation) leading to the installation of a monitoring well(s). In the case of the vicinity of MW-6, the goal is to determine if contamination from the Town of Griffith underground storage tanks has impacted MW-6.

The goals of the Lower Aquifer investigation are:

- Better determine the stratigraphy of the Lower Aquifer
- Determine the Vertical Extent of VOC impacts in the Vicinity of MW-9 in the Lower Aquifer
- Determine if VOCs have reached the groundwater point of compliance (POC) downgradient from MW-9, and if so determine their vertical concentration profile in the Lower Aquifer
- Determine the vertical gradients in the Lower Aquifer
- Determine if dense, non-aqueous liquids (DNAPLs) are present in the Lower Aquifer

The Lower Aquifer Investigation will include the vertical profiling of the Lower Aquifer on the west side of the site, where VOC impacts have been identified (i.e., the vicinity of MW-9). Vertical profiling will be conducted at two boring locations and will consist of installing and sampling temporary monitoring wells on ten foot centers as each of the borings is advanced (i.e. one groundwater sample will be collected for each ten feet of thickness as the boring is advanced). One boring will be installed in the vicinity of MW-9 and the second will be installed downgradient of MW-9 at the groundwater POC. Vertical profiling will provide stratigraphic data, the vertical distribution of VOCs, and determine if dense non-aqueous liquids (DNAPLs) are present. Wells will be installed at the completion of the vertical profiling to provide analytical confirmation samples and water level measurements for the determination of vertical gradients.

It is anticipated that the VOC impacts in the Lower Aquifer will decrease with depth, therefore, at the vertical profile boring near MW-9, the well would be installed below the plume to monitor any vertical migration of the plume. At the vertical profile boring downgradient of MW-9 at the POC, the well would be installed at the depth at which the highest concentration of VOCs were detected, or if VOCs are not detected, the well would be installed at a depth approved by the U.S. EPA and IDEM. The Lower Aquifer Investigation vertical profiling would not begin until the Perimeter Groundwater Containment System is operational and has met its gradient control Performance Standard. At that time contaminants in the upper aquifer will be pulled away from the area of MW-9, which will minimize the potential of cross-contamination of the Lower Aquifer due to drilling through the clay confining layer.

A Lower Aquifer monitoring well will also be installed upgradient of the site between Colfax Road and the nearest residential well location to provide an additional monitoring point in the Lower Aquifer between the ACS site and the nearest residential wells.

The Work Plan outlines a monitoring network , based on existing data, of twelve Upper Aquifer monitoring wells and seven Lower Aquifer monitoring wells that will be sampled and analyzed on a quarterly basis to monitor the nature, character and extent of the groundwater contamination plume prior to construction and operation of a Perimeter Groundwater Containment System and the Remedial Design for the remaining groundwater components. The proposed list of wells will be reviewed based upon the new data generated during the groundwater contamination extent investigation. Wells may be added or deleted from the list based on the new data.

If contaminants are detected above the Performance Standards as defined in the ROD during the Detection/Compliance Monitoring Program, a plan to investigate the exceedence will be submitted to the U.S. EPA and IDEM within two weeks of sampling data validation. If constituents are detected that are not listed in Appendix B of the SOW, they will be evaluated to determine if they are present at a concentration that in combination with the other compounds detected, would exceed a cumulative risk of 1.3×10^{-5} cancer risk or a cumulative non-cancer risk of hazard index greater than unity as established in the ROD. If the detection of a non-Appendix B (SOW) constituent results in the exceedance of these ROD established levels, then an exceedance investigation plan will be submitted to the U.S. EPA and the IDEM. The exceedence investigation plan will include recommendations which may include: retesting of selected monitoring wells, additional groundwater investigation, or residential well sampling downgradient of the well where groundwater sample results indicate an exceedence of the Performance Standards.

An investigation will be conducted in the wetlands to further define potential impacts from the ACS site. The investigation will determine if elevated levels of site related contaminants are widespread in order to decide whether toxicity testing and /or bioaccumulation studies should be performed. The surface water and sediment sample parameters for this investigation were selected based upon the U.S. EPA finding that a specific constituent may pose a risk to wetland or aquatic species, and if the constituent was actually detected in groundwater, surface water or sediment samples near the wetlands. The surface water and sediment samples will be collected from locations where the U.S. EPA made a finding that the constituents may pose a risk to a wetland or aquatic species. The actual locations will be determined in the field in collaboration with U.S. EPA and IDEM.

Two monitoring wells and two unused ACS industrial water supply wells that were previously installed at the ACS site by others will be abandoned during the Pre-Design because of the potential for these wells to serve as a contaminant transport pathway to the Lower Aquifer. One well is used as a part of the Town of Griffith Landfill Monitoring Network, therefore, the Town may need to replace the well.

As a part of the Pre-Design, a soil ISVE pilot test, waste ISVE pilot test, pre-treatment material handling pilot test and LTTT bench test will be performed. The ISVE/Bioventing test for soil will be conducted in the On-Site Containment Area. The ISVE/Bioventing study for waste will be conducted in the Still Bottoms Pond area. A pre-treatment/material-handling

pilot test for waste will be conducted in the Off-Site Disposal area, and samples collected during this test will be used to conduct bench-scale treatability testing for LTTT.

The Pre-Design Work Plan includes a schedule for activities to be conducted. The schedule also shows the interaction of the Pre-Design with expedited activities that will include the installation and operation of the Perimeter Groundwater Containment System and the installation and operation of dewatering systems to dewater waste areas prior to conducting treatability studies. The Work Plan also includes a list of deliverables required which includes: Technical Memorandums, QAPP addendums, and the draft and final Pre-Design report.

JDA/lhd/MJH
J:\4077\0030\WORK PL\VER 2\PRE DES\EXECFNL.WPD

1

INTRODUCTION

1.1 PURPOSE

This Pre-Design Work Plan was prepared by Montgomery Watson Americas, Inc. (Montgomery Watson) on behalf of certain Respondents in response to the Unilateral Administrative (UAO) Order issued by the United Stated Environmental Protection Agency (U.S. EPA), Region V, on September 30, 1994. The purpose of the Pre-Design task is to develop additional data needed to prepare the Remedial Design for the Site remedy.

The major components of the selected remedial action include:

- Groundwater pumping and treatment system to dewater the Site and to contain the contaminant plume with subsequent discharge of the treated groundwater to surface water and wetlands;
- Excavation of approximately 400 buried drums in the On-site Containment Area for off-site incineration;
- Excavation of buried waste materialsand treatment by low-temperature thermal treatment (LTTT).
- On-site treatment or off-site disposal of treatment condensate;
- Vapor emission control during excavation and possible immobilization of inorganic contaminants after LTTT;
- Off-site disposal of miscellaneous debris;
- In-situ vapor extraction pilot study of buried waste in the On-site Area;
- In-situ vapor extraction of contaminated soils;

- Continued evaluation and monitoring of wetlands and, if necessary, remediation;
- Long term groundwater monitoring;
- Fencing the Site and possible implementation of deed and access restrictions and deed notices (Note: Deed restrictions are already in place on the ACS and CSX Transporations property) ; and
- Private well sampling with possible well closures or groundwater use advisories.

The Pre-Design work is needed to:

- Further define the current nature, character, and extent of groundwater contamination in the Upper Aquifer and Lower Aquifer
- Develop a Detection/Compliance Monitoring Program
- Make evaluations regarding residential well sampling
- Provide Site security
- Provide additional evaluation of the wetlands
- Abandon wells that have the potential to be a conduit for contamination to the Lower Aquifer
- Perform ISVE pilot testing in contaminated soils to develop data needed to design the full-scale soil ISVE system
- Perform ISVE pilot testing in On-site area buried wastes to develop the data needed to evaluate the role ISVE can play in the full-scale remediation of the waste areas
- Perform an excavation material handling pilot study to develop data regarding wet material separation, fugitive VOC emissions, debris generation rates, debris decontamination and disposal and other physical aspects needed to prepare full-scale design
- Perform LTTT bench scale pilot testing to develop design data for the operation of a full-scale thermal desorption system.

1.2 WORK PLAN COMPONENTS

The requirements for the Pre-Design Work Plan are described on page 18 and 19 of the Statement of Work (SOW) attached to the UAO. The Pre-Design Work Plan must address the following:

- Perimeter Fence Installation
- Excavation and Off-Site disposal plan for intact buried drums in the On-Site Containment Area
- Investigations in the Wetlands
- Identification of existing or proposed additional compliance and detection monitoring wells
- Residential well sampling
- Insitu Vapor Extraction (ISVE) Pilot study for buried wastes
- Treatability studies for Low Temperature Thermal Treatment (LTTT) and ISVE effectiveness on buried wastes and contaminated soils
- Refining lead cleanup levels using the Biokinetic Uptake Model
- Other studies needed for Pre-Design purposes

The Pre-Design Work Plan includes a Quality Assurance Project Plan, Health and Safety Plan, Field Sampling Plan, and schedule.

The SOW requirements for the "Identification of Contaminated Groundwater" (p. 3., II.C.) have been included in the Pre-Design Work Plan because information generated by this requirement will be useful in the Remedial Design. This item requires a determination of the extent of groundwater contamination, and the development of a groundwater monitoring program.

The abandonment of four wells at the Site is not required by the SOW but is recommended to promptly address the potential for these wells to serve as a conduit of contamination from the Upper Aquifer to the Lower Aquifer. One of the wells ATMW4D was installed by ATEC Associates for the ACS Site owners. Another well, monitoring well MW4D, was installed by the landfill owner/operators to monitor the Griffith Municipal Landfill. The ACS plant also has two industrial water supply wells screened to the Lower Aquifer that are no longer is use.

There are two items required by the SOW for the Pre-Design Work Plan that would more efficiently be addressed in the Remedial Design/Remedial Action. These include the Intact Drum Removal Plan, and the refining of the lead clean up level with modeling.

The assumed goal of preparation of the Intact Drum Removal Plan prior to the preparation of the design documents would be to expedite the excavation and off-site disposal of the intact buried drums. However, test pitting conducted after the RI, (which was discussed with, but conducted without on-site supervision of the U.S. EPA), to collect waste samples for

treatability testing indicated no evidence of intact buried drums. In order to adequately search for intact drums (if present), non-intact drums and other waste and contaminated soil would have to be excavated, but there would not be a treatment system yet on-site to treat these excavated materials. Therefore, the materials would have to be replaced into the excavation, or stored on-site until treatment was available. Given the problems that this excavation would create, the intact drum removal will be performed during the Remedial Action. The Intact Drum Excavation Plan will be included with the Remedial Design documents to benefit from the results of the excavation material handling pilot study, and will be conducted during the Remedial Action. A Perimeter Groundwater Containment System will be installed on an expedited basis to address short-term contaminant migration concerns.

The lead clean-up level modeling will not impact the Pre-Design Studies. It is proposed that the lead cleanup level modeling be included in the Performance Standard Verification Plan which is a required component of the intermediate design submittal. A lead cleanup level has already been established for the Site, and the need for modifications to a particular standard, and the potential impacts of such modifications should be considered in the context of the cleanup levels for the entire Site, using the guidance available at that time.

1.3 GENERAL APPROACH

The Pre-Design activities will include the installation of a fence with associated inspections, a groundwater investigation, a Detection/Compliance Groundwater Monitoring Program, a wetlands investigation, and pilot and bench scale treatability studies. Each of these activities will be conducted in a manner minimizing adverse effects to the environment.

Provisions for site investigation/site monitoring are composed of four distinct activities:

- Groundwater contamination extent investigation
- Detection/compliance monitoring program
- Wetlands investigation
- Well abandonment

The groundwater contamination extent investigation is to determine the current extent of groundwater contamination in the Upper Aquifer and Lower Aquifer. After the extent of groundwater contamination is determined, the Detection/Compliance Monitoring Program will be finalized. The Work Plan specifies a process for finalizing the Detection/Compliance Monitoring Program. An investigation will be conducted in the wetlands to further define potential impacts from the ACS site. The investigation will determine if elevated contaminant levels are widespread in order to decide whether toxicity testing and /or bioaccumulation studies should be performed. , New and certain existing wells will become part of the quarterly Detection/Compliance Groundwater Monitoring Program.

Concurrent with the Pre-Design activities is the anticipated design and construction of the Perimeter Groundwater Containment System. The design of this groundwater extraction and

treatment system is expected to begin prior to the approval of Pre-Design Work Plans, and the design effort will include an aquifer pump test and a groundwater treatability study. For additional details see the "Perimeter Groundwater Containment System RD/RA Work Plan". The Perimeter Groundwater Containment System wastewater treatment plant is integral to the pilot testing to be performed as part of the Pre-Design Activities. It is anticipated that the Perimeter Groundwater Containment System treatment plant will be designed to treat water from the pilot test cell areas.

The pilot tests at the Site will include a soil ISVE test, a waste ISVE test, and a pretreatment/material handling pilot test. In each of these tests, much of the materials to be tested are water-saturated and below the water table. The water table needs to be lowered in test cells and the moisture content of the material being tested needs to be reduced to be consistent with that expected at full-scale operation in order to make the test results useful for full-scale design. Due to the shallow water table at the Site, dewatering in pilot test cell areas is needed to properly conduct the tests. Such dewatering would generate large volumes of water which must be properly treated in a practical manner. It is expected that the LTTT treatability study will be conducted in a laboratory at bench scale with the samples obtained from the Site during the material handling pilot test.

The SOW (pg 11) allows additional Pilot scale testing on other innovative technologies. If information comes available during the Pre-Design that a technology may by appropriate for the site and treatability tests are warranted, then an addendum to this plan will be submitted to U.S. EPA and IDEM for review and approval.

J:\4077\0030\WORK PL\VER 2\PRE DES\SEC1FNL.WPD

2

SITE BACKGROUND

2.1 SITE HISTORY

Operational History

The ACS site is located at 420 South Colfax Avenue in Griffith, Indiana. The site is bordered on the east and northeast by Colfax Avenue. The Chesapeake and Ohio railway bisects the site in a northwest-southeast direction, between the fenced On-Site Area (north) and the Off-Site Area (south). On the west and northwest, south of the Chesapeake and Ohio railway, the Site is bordered by the abandoned Erie and Lackawanna railway, and the active portion of the Griffith Municipal Landfill. North of the Chesapeake and Ohio railway, the site is bordered on the west by wetland areas. The northern boundary of the Site is formed by the Grand Trunk railway (Figures 2-1and 2-26). There are five land disposal areas at the ACS site: On-Site Containment Area, Still Bottoms Area, Treatment Lagoons, Off-Site Containment Area and Kapica/Pazmey Area. The Griffith Municipal Landfill is located within the boundaries of the Site, however, it is not a part of the remedy at the Site. The Griffith Municipal Landfill is an active solid waste disposal facility currently going through closure and has operated since the 1950s.

Based on information provided by American Chemical Service, Inc., the ACS facility began operation in May, 1955 as a solvent recovery facility. Solvent recovery remained the primary operation performed on-site through in the late 1960s, when the manufacture of small quantities of specialty chemicals began. These manufacturing operations included treating rope with fungicide, bromination and treating ski cable.

In 1961, ACS sold a two-acre parcel to John Kapica, and in 1962 Kapica began the operation of his drum reclaiming business at the location. Operations at Kapica Drum, Inc. consisted of drum reconditioning. Kapica Drum was sold to Pazmey Corporation in February 1980. Kapica/Pazmey operated from 1980 to 1987. The Pazmey Corporation property was sold to Darija Djurovic in March 1987.

ACS' solvent operations involved spent solvent mixtures containing alcohols, ketones, esters, chlorinated solvents, aromatics, aliphatics, and glycols. In the early years of operation, spent solvents were stored in 55-gallon drums at various locations at the Site. Solvent recovery was

performed in batch evaporation units, which were charged by pumping material directly from 55-gallon drums into the evaporation vessels. Still bottoms from the evaporation vessels were disposed in the Still Bottom Pond, prior to the installation of incinerators at the facility. ACS installed its first incinerator in 1966 and installed a second incinerator in 1969. The incinerators were used to burn still bottoms and non-reclaimable materials generated at the site, and wastes from off-site. The incinerator units were dismantled in 1977.

From 1970 to 1975, the spent solvents reclaimed at the Site were similar to those which were handled in the 1960s. However, an increasing percentage of shipments were received at the Site in bulk tanker trucks. In addition, the batch manufacturing processes were expanded during this period. A lard oil process which utilized tallow and animal rendering was used to manufacture a lubricant product. This process, along with a soldering flux operation, was discontinued prior to 1990. In 1971, the additive manufacturing area was built. Various detergents, lubricants, and chemical additives were manufactured, in addition to soldering flux, various amines, methanol, formaldehyde, sodium hydroxide, and maleic anhydride. An epoxidation plant was constructed in 1974 and a bromination operation using hexane was added in 1975. At various times up until 1990, the epoxidation plant used toluene or benzene as a reaction carrier.

Some time between 1975 and 1990, the solvent distillation units were replaced with new units though the types of solvent wastes reclaimed remained essentially the same. Spent solvent and reclaimed solvent recovery tank farms were constructed during this time period and the majority of the spent solvent waste streams were shipped in bulk tanker trucks, although drummed wastes were still processed. A waste drum unloading dock and storage area were built in the early 1970s, with spill containment curbing and a sump area added at a later date. In September, 1990 ACS ceased hazardous waste shipments and filed for closure. On March 31, 1993 ACS completed closure and terminated its interim RCRA status. ACS currently operates as a chemical production facility at the Site.

Land Disposal History

When ACS began operations in 1955, the still bottoms from the solvent recovery operations were disposed of in the Still Bottoms Pond/Treatment Lagoon area. In 1972, the pond and lagoons were drained, and drums, partially filled with sludge materials, were landfilled there. The Off-Site Containment Area was utilized for the landfilling of wastes including excavated materials from the Still Bottoms/Treatment Lagoon from 1958 to 1975. The waste types disposed of in the Off-Site Containment Area over the course of ACS' operations also included general refuse, drums, still bottoms and incinerator ash. According to ACS, Inc. owner/operators, all drums placed in the Off-site Area were crushed or punctured as part of the disposal process.

During the mid-1960s, it is estimated that approximately 400 drums of sludge and semi-solids were landfilled in the On-Site Containment Area. Observations made during test pit excavations in 1993 did not detect any intact drums. Residual wastes and rinse waters from

the Kapica/Pazmey drum reconditioning operation were disposed of on the ground in the Kapica/Pazmey Area.

Administrative History

In February 1980, the U.S. EPA performed a Preliminary Assessment of the ACS site, collecting samples in the Off-Site Containment Area and at the Griffith Municipal Landfill in May 1980. The U.S. EPA performed a Site Inspection on September 9, 1980 and in July, 1982, U.S. EPA contractors installed four monitoring wells near the Off-Site Containment Area and the Griffith Landfill. Based upon information developed during these investigative efforts, a Hazard Ranking System score of 34.98 was assigned to the ACS Site by U.S. EPA in June 1983.

In 1986, a group of approximately 125 Potentially Responsible Parties (PRPs) formed a Steering Committee to conduct the RI/FS pursuant to an agreement with the U.S. EPA. The PRPs signed a Consent Order to perform the RI/FS in June 1988. Following U.S. EPA approval of the RI/FS Work Plan, the field investigation for Phase I of the RI began in July, 1989. Phase II RI field work began in March 1990, and; in December 1990, the Phase III RI field work was initiated. The RI report was completed in June 1991. Warzyn (now Montgomery Watson Americas, Inc.) completed the FS report in June 1992.

In June 1992, the U.S. EPA published notice of its Proposed Plan for Remedial Action for the ACS site. The remedy presented in that Proposed Plan was described by U.S. EPA as a modification of Remedial FS Alternative 6B. The U.S. EPA issued a ROD in September 1992. The UAO was issued on September 30, 1994. The Respondents provided notice to the U.S. EPA of their intent to comply with the UAO, and have developed the planning documents and performed other tasks required by the UAO to date.

2.2 PHYSICAL SETTING

Surface Features and Topography

The ACS Site is located in northwestern Indiana in Section 2, Township 35 North, Range 9 West in Griffith, Lake County, Indiana (Figure 2-1). This area lies within the Calumet Lacustrine Plain, a subdivision of the Northern Moraine and Lake Region (Hartke, et. al., 1975).

The Calumet Lacustrine Plain is located within the lake bed of glacial Lake Chicago. The landscape is generally low-lying, and predominantly the result of continental glacial processes, and lacustrine processes associated with the formation of glacial Lake Chicago and present-day Lake Michigan. Dominant features of the landscape include three relict shorelines representing successively lower states of glacial Lake Chicago, the high dunes of the present shoreline of Lake Michigan and abundant low-lying marsh and wetland areas.

The Calumet Lacustrine Plain is characterized by generally low relief, due to its location within the lake bed of glacial Lake Chicago. In the immediate vicinity of the Site, surface elevations range from about 650 to 630 ft, MSL. The higher elevations represent relict sand dunes located east of the Site, while the lower elevations are associated with wetland areas to the west and south of the Site.

The U.S. Geological Survey topographic map of the region indicates that the local surface drainage is from the north to the southwest. Surface water runoff is captured within the site boundaries in the form of internal drainage or infiltration. To the north of ACS, surface water from off site enters through a culvert under the railroad tracks. The culvert connects to a drainage ditch south of the railroad. This ditch flows west along the northern site boundary and into the drainage ditch cut north to south through the wetlands.

Wetland areas have been defined in the immediate vicinity of the site (Figure 2-2). These wetlands are described in detail in the report "Wetlands Delineation at American Chemical Services Hazardous Waste Site, Griffith, Indiana, IAG-DW14934313-0, U.S. Fish and Wildlife Service, May, 1990" (Appendix N of the Remedial Investigation Report).

Regional Hydrogeology

A variety of unconsolidated materials are found within the limits of the Calumet Lacustrine Plain. These materials include fine lake silts and clays, muck and peat, beach and dune sands, sand and gravel outwash, and glacial tills. These materials represent a complex depositional history, including fluctuating lake levels and associated beach and dune formation and the accumulation of sand and gravel outwash deposits (Hartke, et al., 1975).

The glacial deposits in the immediate site vicinity are approximately 130 feet thick. These deposits have been subdivided into four units: an upper sand and gravel unit, and intermediate clay unit, a lower sand and gravel unit, and a lower clay till unit which directly overlies bedrock. Three hydrostratigraphic units have been identified in the glacial deposits in the site vicinity. These units include, in descending order, an uppermost aquifer (Calumet Aquifer), a clay confining layer and a lower aquifer (Valparaiso Aquifer).

The bedrock geology in the Site consists of more than 4,000 feet of Paleozoic shales, sandstones, and carbonates, overlying Precambrian granitic basement. The youngest bedrock unit present in the Site area is Antrim Shale of Devonian age (approximately 260 million years old). The Devonian Detroit River and Traverse Formations, composed of limestone with some karst, underlie the town of Griffith (CDM, 3/26/85).

The bedrock underlying in the Site area are gently folded to form part of the Kankakee Arch, a saddlelike structure that forms a high between the Michigan Basin on the northeast and the Illinois Basin on the southwest. Regional dip is generally to the southeast, at a rate of five to seven feet per mile. The bedrock surface is largely a preglacial erosional feature, and is not reflected in the surface topography. Bedrock surface elevations in the site area range from

about 450 feet, Mean Sea Level (MSL) near Lake Michigan to about 650 feet, MSL in southern Lake and Porter counties. The higher bedrock elevations south of the site represent a northeast-southwest trending bedrock ridge of Devonian limestone and shale (Hartke, et al., 1975).

Site Hydrogeology

The RI and other previous investigations have developed Site specific hydrogeological data which are summarized below. The existing monitoring well system is shown on Figure 2-3. Three units have been identified within the glacial deposits at the ACS Site. These units are: an upper sand and gravel unit, and intermediate silty clay unit, and a lower sand and gravel unit. The stratigraphic relationships among these units are illustrated in Figures 2-5 through 2-8, which are cross-sections of the ACS Site (Figure 2-4 is the cross-section location map), and discussed below.

Upper Sand and Gravel Unit (Upper Aquifer)

The Upper Sand and Gravel Unit at the site generally consists of a brown to dark gray, fine to coarse sand with trace to little fine to coarse gravel, trace clay, and trace silt. It is generally classified as SP or SM under the Unified Soil Classification System. This unit often becomes siltier and finer grained near its contact with the underlying clay unit. In the Site monitoring wells, the Upper Sand and Gravel Unit ranged in thickness from about 13 to 32 feet, with an average thickness of about 17 feet.

Average permeability values (K) for the upper aquifer material are:

Geometric Mean: $K = 7.9 \times 10^{-3}$ ft/min
4.0×10^{-3} cm/sec

Based on the in-situ hydraulic conductivity tests, the average values for the permeability in the upper aquifer on the east and west side are as follows:

East side Mean: $K = 1.5 \times 10^{-2}$ ft/min
7.6×10^{-3} cm/sec

West side Mean: $K = 2.9 \times 10^{-3}$ ft/min
1.5×10^{-3} cm/sec

Groundwater flow directions in the Upper Aquifer are generally westward with northerly and southerly components (Figure 2-9 and Figure 2-10) (also see Figures 4-17, 4-18 and 4-19 of the RI Report). There are four primary hydraulic controls in the upper aquifer flow pattern which are superimposed to create the observed potentiometric surface: 1) the regional gradient; 2) discharge to drainage ditches; 3) de-watering activities at the Griffith Municipal Landfill; and 4), recharge which occurs primarily at the cleared and filled areas. A fifth minor control is a ditch located west of the Off-Site Area, which extends northward from staff gage SG-1 for several hundred feet and discharges in to a marshy area with an elevation below 630

feet.

Shallow groundwater discharges to the ditch north of the wetlands and to the ditch that runs north-south through the wetlands. De-watering at the Griffith Municipal Landfill has been continuous since at least 1986. It appears that landfill de-watering kept the upper aquifer groundwater 6 to 10 ft below its natural level of approximately 630 ft msl in that area. Infiltration of precipitation is enhanced across the entire fenced ACS facility, because within the fenced area, the surficial material is coarse-grained crushed limestone gravel and vegetation is sparse. The Fire Pond also appears to provide recharge to the upper aquifer.

Silty Clay Unit (Clay Confining Layer)

The clay layer found underlying the Upper Sand and Gravel Unit at the Site has been classified as a gray silty to lean clay with trace to some fine to medium sand and trace fine to coarse gravel. Some fractures were noted in this unit. Under the Unified Soil Classification System (USCS) the unit has been classified as a CL to CL-ML.

Generally, the top of clay is at an elevation of approximately 620 ft, MSL as presented in Figure 2-11. The silty clay layer was found to range in thickness from an estimated minimum of 2.5 feet at boring CB-1 adjacent to monitoring well MW-10C to a maximum thickness of 18.1 feet at monitoring well MW-7 (Figure 2-3). The clay is thinnest in the northwestern portion of the Site. The clay layer is thickest to the south and continuous throughout the investigation area. The clay averages about 10 feet thick over most of the Site (Figure 2-12).

The clay vertical permeability values ranged from 5.8×10^{-9} cm/sec to 6.7×10^{-7} cm/sec with a geometric mean value of 4.8×10^{-8} cm/sec. Total porosity was laboratory measured for two samples from the clay layer. The total porosity values were 0.257 and 0.327 (unitless). The vertical gradients vary from 0.71 to 1.43. The average vertical gradient is approximately 1 (unitless).

Figures 2-5 to 2-7 show the clay unit to be more than 10 feet thick throughout the waste areas. The silty clay is a significant barrier to fluid flow as indicated by the hydraulic head difference between the upper and lower aquifers. For example, a comparison of Figures 2-10 (Upper Aquifer) and Figure 2-14 (Lower Aquifer) shows that the upper aquifer has a ten-foot higher water elevation caused by the clay. In addition, although some contaminants were detected in the upper aquifer as pure product, only very low part per billion concentrations have been detected in the lower aquifer. Therefore, the clay is significantly restricting the vertical migration of contaminants.

Lower Sand and Gravel Unit (Lower Aquifer)

The Lower Sand and Gravel Unit at the Site consists of a brown to dark gray fine to coarse sand with trace to some gravel and trace silt and pebbles. Under USCS classification, the soils from this unit are considered SP-SM. Silty layers and silty clay layers are common within the upper portion of this unit, based on borings performed for the lower aquifer wells

at the Site.

The permeability (K) values of the lower aquifer material ranged from 4.2×10^{-2} ft/min at MW-9 to 4.6×10^{-3} ft/min at MW-7 and MW-10. The geometric mean value for the four tests is:

Geometric Mean: $K = 4.4 \times 10^{-2}$ ft/min
3.2×10^{-2} cm/sec

Groundwater flow direction in the Lower Aquifer is towards the north (Figures 2-13 and 2-14) (also see Figures 4-23 and 4-23a of the RI Report). The lower clay till unit and the underlying bedrock were not encountered in any of the borings performed for the Remedial Investigation. However, the driller's log for an on-site water supply well indicates that the Lower Aquifer extends to bedrock at the Site.

On-Site Production Wells

ACS has four active production wells located on-site (Figure 2-29). Based on conversations with ACS personnel, each production well is believed to be drilled to a depth of 265 to 500 feet and constructed of 4-inch steel casing of at least 130 feet in length. Each well has a five horsepower Gould submersible pump lowered to approximately 120 feet. The approximate flow rate of each pump is 45 gallons per minute. Water withdrawal records prepared for the IDNR indicate that production Well No. 1 averaged about 33,000 gallons per month, No. 2 averaged about 185,000 gallons per month, and Well No. 4 averaged about 193,000 gallons per month. Production Well No. 3 withdrew 3,000 gallons in January, May, July and October of 1994 (12,000 gallons total) and was not used in the remaining months. Water withdrawal records for 1994 are presented in Appendix A. ACS also has two inactive wells at the site.

Extent of Waste and Groundwater Contamination

Buried wastes are present in the On-Site Containment Area, Still Bottoms/Treatment Lagoon Area, the Off-Site Containment Area and the Kapica/Pazmey Area. The volume of buried waste is estimated to be 120,000 cubic yards. The waste constituents include materials with greater than 1% VOCs, and SVOCs, PCBs, and metals at levels above the Performance Standards. Surrounding each of the buried waste areas are contaminated soils. Contaminated soils contain VOCs and SVOCs at concentrations above the Performance Standards. The RI report indicated a strong, positive correlation between the distribution of BETX and other Site contaminants.

The extent of groundwater BETX contamination in the Upper Aquifer is depicted in Figure 2-15. The presence of contaminants in a currently upgradient location is believed to be due to past groundwater mounding in the Off-Site Containment Area, and potentially related, to the Town of Griffith's underground storage tank (UST). RI sample results from off-site monitoring wells located outside of the BETX plume shown on Figure 2-15 were below the Performance Standards. No contaminants were detected above the Performance Standards in the lower aquifer during the RI.

2.3 EXPEDITED GROUNDWATER SAMPLING

Expedited groundwater sampling was performed at the ACS Inc. facility in December 1994 and January 1995. One round of groundwater samples was collected from the 22 monitoring wells (MW03 through MW24). Monitoring well MW01 had been destroyed, apparently by railroad maintenance activities, due to the presence of a wide area of newly placed gravel at the well location vicinity. MW02 could not be sampled due to a bent casing. Groundwater samples from each well were analyzed for VOCs (full TCL scan), SVOCs (full TCL scan), PCBs, and arsenic, berrylium, manganese, and thalium (total and dissolved metals). Samples for total metals were not filtered while samples for dissolved metals were filtered.

Groundwater samples were collected with either a low flow submersible pump or a stainless steel bailer. The bailer was used to collect samples west of Colfax from the interior of the site because the high concentrations of contaminants would have made decontamination of the pump very difficult. The submersible pump was used for wells around the perimeter of the site where low concentrations of compounds were anticipated.

Analyses were performed in accordance with the Contract Laboratory Program (CLP) SOW. TCL organics analyses were performed by IEA Analytical Laboratories, North Carolina. Metals analyses was performed by Montgomery Watson's analytical laboratory in Madison, Wisconsin. Lab analyses were performed at Data Quality Objective (DQO) Level IV (i.e. CLP data packages as agreed with the U.S. EPA and IDEM), and Montgomery Watson validated the data. The results represent the most recent groundwater analytical data depicting the site conditions.

Summary of Detected VOCs

Detected VOCs during the expedited groundwater sampling performed during the period of December 30, 1994 through January 5, 1995 are summarized on Table 2-1. VOCs which were detected the most frequently are presented on Figures 2-16 through 2-25.

The extent of groundwater contamination has not changed significantly since the last sampling rounds in 1990 and 1991. In general, the upper aquifer can be characterized as having very high concentrations of contaminants (free product and thousands of parts per billion VOCs) throughout the interior of the site with much lower concentrations (non detect to low parts per billion) around the site perimeter. Concentrations of an individual compound at an individual well may have changed but overall, the results are similar. In a few cases, compounds that were not detected at an individual well in 1990 and 1991, were found in December 1994 and January 1995. Summaries of the compounds detected in the upper aquifer are presented below and on Figures 2-16 to 2-22.

The extent of groundwater impact in the lower aquifer was generally similar to the 1990 and 1991 results. Monitoring Well MW-9, in which VOCs were detected in 1990 and 1991 also had VOCs detected in December 1994 and January 1995. Benzene which had not been detected earlier was found in this latest round of sampling. Very low levels of a few other compounds were also detected in a few wells in the latest round. Summaries of the

compounds detected in the lower aquifer are presented below and on Figures 2-23 to 2-25.

Upper Aquifer Monitoring Wells
Benzene was detected in 10 upper aquifer monitoring wells. Concentrations ranged from 2 ug/l in wells MW12, MW15, and MW19 to 27,000 ug/l in MW3 (Figure 2-16). Chloroethane was detected in nine upper aquifer monitoring wells, at concentrations ranging from 2 ug/l in MW12 to 3,100 ug/l in MW16 (Figure 2-17). The compound 1,2-Dichloroethane was detected in four upper aquifer monitoring wells at concentrations ranging from 9 ug/l in MW17 to 140 ug/l in MW16 (Figure 2-18). The compound 4-Methyl-2-Pentanone was detected in wells MW5 (6 ug/l) and MW16 (1,400 ug/l). The sample collected from the Griffith Landfill monitoring well MW4S, sampled on January 26, 1995, detected 4-methyl-2-pentanone at 63 ug/l (Figure 2-19). Ethylbenzene was detected in four wells with concentrations ranging from 2 ug/l in MW17 to 770 ug/l in MW6 (Figure 2-20). Total xylenes were detected in three upper aquifer monitoring wells at concentrations ranging from 83 ug/l in MW5 to 3,900 ug/l in MW6 (Figure 2-21). Vinyl chloride was detected in wells MW05 (16 ug/l) and MW17 (2 ug/l) (Figure 2-22). Acetone was detected in wells MW14 (47 ug/l) and MW16 (7,700 ug/l). The compound 2-Butanone was in MW16 (15,000 ug/l).

Lower Aquifer Monitoring Wells
The following VOCs were detected in lower aquifer monitoring wells; benzene (40 ug/l) in MW9 (Figure 2-23), chloroethane (650 ug/l) in MW09 (Figure 2-24), 4-methyl-2-pentanone (9 ug/l) in MW10 (Figure 2-25), and 2-butanone (1 ug/l) in MW7 (duplicate sample).

Summary of Detected SVOCs
SVOCs detected during the expedited groundwater sampling performed during the period of December 30, 1994 through January 5, 1995 are summarized on Table 2-2.

Upper Aquifer Monitoring Wells
Bis(2-chloroethyl)ether was detected in six upper aquifer wells with concentrations ranging from 12 ug/l in MW19 to 160 ug/l in MW16. Bis(2-chloroisopropyl)ether was detected in monitoring wells MW5 (34 ug/l), MW12 (150 ug/l), and MW19 (2 ug/l). The compound 2,4-Dimethylphenol was detected in monitoring wells MW3 (5 ug/l), MW6 (58 ug/l), and MW16 (45 ug/l). Napthalene was detected at 2 ug/l in MW3, MW6, and MW17. The compound 1,2-Dichlorobenzene was detected in MW3 (51 ug/l), MW5 (18 ug/l), and MW17 (3 ug/l).

Lower Aquifer Monitoring Wells
Bis(2-chloroethyl)ether was detected in monitoring well MW24 (23 ug/l). Di-n-octylphthalate was detected in wells MW21 (11 ug/l) and MW24 (1 ug/l).

Summary of Detected Metals
Metals detected during the expedited groundwater sampling performed during the period of December 30, 1995 through January 5, 1995 are summarized on Table 2-3. Dissolved metals were filtered in the field during the groundwater sampling effort.

Upper Aquifer Monitoring Wells
Dissolved Metals - Arsenic was detected in all upper aquifer wells, excluding MW11, MW13,

and MW18. Concentrations of arsenic ranged from 1.1 ug/l in MW12 to 43.3 ug/l in MW3. Manganese was detected in each of the 14 upper aquifer monitoring wells, excluding MW18. Concentrations ranged from 123 ug/l in MW15 to 2,480 ug/l in MW5. Thallium was detected in wells MW3 (1.2 ug/l), MW15 (1 ug/l), and MW16 (2.5 ug/l).

Total Metals - Arsenic was detected in each well, excluding MW18. Concentrations of arsenic ranged from 2.5 ug/l in MW13 to 105 ug/l in MW6. Manganese was detected in each upper aquifer monitoring well at concentrations ranging from 253 ug/l in MW11 to 3,890 ug/l in MW4. Thallium was detected in monitoring wells MW4 (3.6 ug/l), MW5 (1.1 ug/l), MW19 (1.9 ug/l), and MW20 (1.5 ug/l).

Lower Aquifer Monitoring Wells

Dissolved Metals - Arsenic was detected in lower aquifer wells MW08 (3.4 ug/l), MW09 (2.9 ugl), and MW22 (3.6 ug/l). Manganese was detected in each lower aquifer well, at concentrations ranging from 60 ug/l in MW10 to 260 ug/l in MW24. Thallium was not detected in any of the lower aquifer wells.

Total Metals - Arsenic was detected in each well, excluding MW10. Concentrations ranged from 1.3 ug/l in MW07 (duplicate sample) to 22.5 ug/l in MW24. Manganese was detected in each well, with concentrations ranging from 72 ug/l in MW10 to 1,670 ug/l in MW24. Thallium was detected in MW24 (1.8 ug/l).

Summary of Detected PCBs

PCBs detected during the expedited groundwater sampling performed during the period of December 30, 1995 through January 5, 1995 are summarized on Table 2-4.

Upper Aquifer Monitoring Wells

Aroclor-1248 was detected in MW03 at a concentration of 1.4 ug/l. No other PCBs were detected in any of the upper aquifer monitoring wells.

Lower Aquifer Monitoring Wells

No PCBs were detected in the lower aquifer monitoring wells.

2.4 SURROUNDING LAND USE

The site is bordered on the east and northeast by Colfax Avenue. The Chesapeake and Ohio railway bisects the Site in a northwest-southeast direction, between the fenced On-site Area (north) and the Off-site Area (south). On the west and northwest, south of the Chesapeake and Ohio railway, the Site is bordered by the abandoned Erie and Lackawanna railway and the active portion of the Griffith Municipal Landfill. North of the Chesapeake and Ohio railway, the Site is bordered on the west by wetland areas. The northern boundary of the Site is formed by the Grand Trunk railway (Figure 2-1). The Site and surrounding land is zoned for industrial use (Figure 2-12). The owners of the ACS Site have filed deed restrictions which prevent residential development of the Site or groundwater use at the Site without prior written

approval of the U.S. EPA. Developed land around the Site is used for industrial purposes and single family residences.

The private wells in the immediate site vicinity (i.e., 1/2 mile radius), which are used for drinking water purposes, draw water from the Lower Aquifer. The Upper Aquifer wells within 1/2 mile of the Site are not used as drinking water supplies. These wells are typically used for lawn watering and utility usage, as described in Table 2-6 of the RI Report. The locations of private wells identified near the Site are shown on Figure 2-13. Available information regarding water supply wells are presented in Table 2-6 and Appendix of the RI Report.

J:\4077\0030\WORK PL\VER 2\PRE DES\SEC2FNL.WPD

3

SITE SECURITY

A fence will be installed to prevent unauthorized access and vandalism at the Site. The ACS manufacturing plant is already enclosed within a chain link fence as shown on Figure 3-1. The existing chain link fence is six-ft high with three-strands of barbed wire at the top meeting the requirements of the SOW. No additional fencing is proposed for the Onsite Areas. A fence will be installed in the Off-Site Areas approximately as shown on Figure 3-2. This chain-link fence will be a minimum of 6 ft high with three-strand barbed wire at the top. There will be three double-wide gates providing vehicle access. A property survey in the Off-Site Areas will be conducted prior to installation of the fence and the fence line will be adjusted to extend to the ACS property boundaries based upon the surveyors report.

Reflective warning signs will be posted on the fence at approximately 200-ft intervals, and signs will also be placed on each gate. The signs will state: *"Warning U.S. EPA Superfund Site Authorized Personnel Only. This area contains hazardous chemicals in soil and groundwater call 800- 621-8431 for further information."* The schedule for the fence installation is included in Section 6. The fence will be inspected monthly and repairs made as needed within 7 days of Respondents becoming aware of the need for repairs or receiving notice from the U.S. EPA of the need for repairs. Incidents of vandalism, trespassing and breaches of the fence will be reported to local authorities and the U.S. EPA and IDEM within 24 hours after such incidents are reported to or discovered by the Respondents.

J:\4077\0030\WORK_PL\VER_2\PRE_DES\SEC3_FIN.WPD

4

SITE INVESTIGATIONS/SITE MONITORING

Site Investigation/Site Monitoring is composed of four distinct activities:

- Groundwater Contamination Extent Investigation
- Detection/Compliance Monitoring Program
- Wetlands Investigation
- Well Abandonment

The schedule for these activities is outlined in Section 6.

The purpose of the groundwater contamination extent investigation is to determine the current extent of groundwater contamination in the Upper Aquifer and Lower Aquifer. After the current extent of groundwater contamination is determined, the Detection/Compliance Monitoring Program will be finalized. The extent of groundwater contamination was previously determined during the RI through a combination of permanent (i.e., monitoring wells) and temporary water sampling points (i.e., tracer-type sampling points). Because of the time that has passed since the RI, an additional investigation is needed to determine the current extent of groundwater contamination related to the ACS site.

Groundwater samples were collected from the existing monitoring well network in December 1994 to determine the concentrations of VOCs, SVOCs, PCBs, and selected metals. These results and water level data will be utilized as guides to conducting the tracer investigation in the Upper Aquifer. The tracer investigation will be performed to determine the extent of VOC contaminated groundwater in the Upper Aquifer. The results of the Upper Aquifer tracer investigation will be used to evaluate the Upper Aquifer groundwater monitoring network, and determine the need for additional wells. At this time, three Upper Aquifer monitoring wells are proposed to provide additional permanent monitoring points at the site perimeter. Additional Upper Aquifer monitoring wells may be proposed based upon the results of the tracer investigation.

The process leading to the final determination of the Upper Aquifer Detection/Compliance Monitoring Program is a series of steps as follows:

1. Inventory Water Level Monitoring Points
2. Propose Additional Water Level Monitoring Points
3. Install Additional Water Level Monitoring Points and Obtain a Round of Water Levels

3. Install Additional Water Level Monitoring Points and Obtain a Round of Water Levels
4. Present Water Level Data (figures and table) to the Agencies along with proposed locations for Tracer investigation sampling points in the Upper Aquifer.
5. Conduct Tracer Investigation in the Upper Aquifer as approved by the Agencies
6. Present results of Tracer Investigation of the Upper Aquifer to the Agencies in a Technical Memorandum, with proposed well locations as appropriate
7. Install and sample wells as approved by the Agencies
8. Present results to the Agencies with a proposed quarterly monitoring program in a Technical Memorandum
9. Sample wells on a quarterly basis as approved by the Agencies, until less frequent sampling approved by the Agencies

It is anticipated that technical staff from the Agencies will be in the field during the contamination extent investigation and that the technical memorandums described above will be collaborative efforts that can be completed and approved without demobilizing fromthe field.

The Lower Aquifer Investigation will include the vertical profiling of the Lower Aquifer on the west side of the site, where VOC impacts have been identified (i.e., the vicinity of MW-9). Vertical profiling will be conducted at two locations and will consist of installing and sampling temporary monitoring wells on ten foot centers as the borings are advanced. One boring will be installed in the vicinity of MW-9 and the second will be installed downgradient of MW-9 at the groundwater point of compliance (POC). Vertical profiling will provide stratigraphic data, the vertical distribution of VOCs, and determine if dense non-aqueous liquids (DNAPLs) are present. Wells will be installed at the completion of the vertical profiling to provide analytical confirmation samples and water level measurements for the determination of vertical gradients.

It is anticipated that the VOC impacts in the Lower Aquifer will decrease with depth, and so at the vertical profile boring near MW-9, the well would be installed below the plume to monitor the vertical migration of the plume. At the vertical profile boring downgradient of MW-9 at the POC, the well would be installed at the depth at which the highest concentration of VOCs were detected, or if VOCs are not detected, the well would be installed at a depth approved by the U.S. EPA and IDEM. The Lower Aquifer Investigation vertical profiling would not begin until the Perimeter Groundwater Containment System is operational and has met its gradient control Performance Standard, which will minimize the potential of cross-contamination of the Lower Aquifer due to drilling through the clay confining layer.

A Lower Aquifer monitoring well will also be installed upgradient of the site between Colfax Road and the nearest residential well location to provide an additional monitoring point in the Lower Aquifer between the ACS site and the nearest residential wells.

The purpose of the Detection/Compliance Monitoring Program described below is to determine if the nature, character and plume changes during the period prior to the installation of the Perimeter Groundwater Containment System and the completion of the Remedial Design for the remaining groundwater components. After installation of the Perimeter Groundwater Containment System, the Detection/Compliance Monitoring Program will be modified to monitor the effectiveness of the Perimeter Groundwater Containment System.

modified to monitor the effectiveness of the Perimeter Groundwater Containment System.

The purpose of the wetlands investigation is to provide additional delineation of potential contaminant impacts identified in the wetlands. The investigation will focus on conducting additional sampling in the vicinity of RI sampling locations west of the ACS plant and north of the On-Site Containment Area.

At the site, there are four Lower Aquifer wells that are proposed to be abandoned. These wells appear to have the potential to serve as contaminant migration pathways from the Upper Aquifer to the Lower Aquifer.

The Site Investigation results will be presented in the Pre-Design Report. The report will include an update of the hydrogeological conditions, well abandonment report, new well installation and sampling results, and the results of the Wetland's Investigation.

4.1 GROUNDWATER CONTAMINATION EXTENT INVESTIGATION

4.1.1 Upper Aquifer Investigation

The Upper Aquifer Investigation will be implemented in a stepwise manner as described above leading to the determination of the Detection/Compliance Monitoring Program. The **first step** in the Upper Aquifer Investigation, which is the inventory of the existing water level monitoring points, has been completed and the water level monitoring points are shown on Figure 2-3 and listed in Table 4-3.

The **second step** in the Upper Aquifer Investigation is the proposal for additional water level monitoring points. (For simplicity, both Upper and Lower Aquifer water level monitoring points are discussed under the Upper Aquifer Investigation.) The proposed additional water level monitoring points include Griffith Landfill monitoring wells (M-1S, M-1D, M-2S,M-2D, M-3S, M-3D, M-4S, M-5S, and M-5D), new and replacement staff gauges (SG2R, SG3R, SG4R, SG6R, SG7R, SG11), and new piezometers (P51, P52, P53, P54, P55, P56, P57, P58, P59, and P60) (Figure 4-6). The Griffith Landfill well MW-4D is not included as it is anticipated that it will be abandoned due to the potential for the well to serve as a conduit for contamination from the Upper Aquifer to reach the Lower Aquifer. It is understood that the IDEM may require replacement of this well under the Solid Waste Program. If replacement does occur, the water level in the new well will be corrected. The Griffith Landfill wells will provide water level data around the active portion of the landfill. Piezometers P51-P58 will provide additional water level data east of Colfax Avenue and north of the Grand Trunk Railroad. Piezometers P59 and P60 will provide additional water level data from within the site. The new and replacement staff gauges will provide data to monitor the hydraulic relationship of surface water to groundwater. The proposed monitoring wells will be added to the program after installation.

The **third step** is to install the proposed water level monitoring points as approved by the Agencies and collect water level measurements. The installation will be coordinated with the

Agencies with the actual locations of the water level measuring points determined in the field with concurrence from the Agencies representatives. Water level measurements will be collected once prior to developing the proposal for the Tracer Investigation sampling points. Quarterly water level measurement will continue to be collected on a quarterly basis to provide an indication of potential seasonal variations.

The **fourth step** is to provide the water level data, plotted on maps and compiled into a table, to the Agencies after water level data are collected. These data will be provided to the Agencies with a map depicting the proposed Tracer sampling points. The **fifth step** is to determine the extent of groundwater contamination in the Upper Aquifer consistent with the approved Tracer investigation plan following the procedure described below.

The extent of groundwater contamination will be delineated in the field using VOCs detected in groundwater samples collected from temporary sampling points (i.e., a tracer tool) as an indicator of the extent of contamination. The samples will be field analyzed for a target list of VOCs. VOCs were found to be an indicator of groundwater contamination at this site and VOCs are the most mobile constituents. The strong correlation between VOCs and site contaminants was documented in the RI report. The target list of VOCs is: benzene, ethylbenzene, toluene, xylene, chlorobenzene, 1,2-dichloroethene, and 1,1- dichloroethane. These were the most frequently detected VOCs in groundwater samples collected from the Upper Aquifer (i.e., greater than four detections out of 24 samples) (see Table 7-2 of the ACS Baseline Risk Assessment Report.). Chloroethane was detected greater than four times in the RI but was not included in the field target VOC list because of potential analytical difficulties, and a Performance Standard was not set for chloroethane in the ROD. Chloroethane is one of the four gases on the CLP Target VOC list, and elutes very quickly making it difficult to analyze in the field.

The samples will be analyzed in the field with a gas chromatograph (GC) at Level II Data Quality Objectives (DQO). These analyses will allow field judgements to be made for locating the next sampling point, or determining that the extent of the VOC contamination has been determined sufficiently to locate monitoring wells. It is anticipated that samples will be collected at up to approximately 50 locations to the north, west, and east of the site in the area shown on Figure 4-1. The Tracer Investigation will focus on four areas: Wetlands, North of the Grand Trunk Railroad, vicinity of MW-7, and in the vicinity of well MW-6. In the cases of the Wetlands, North of the Grand Trunk Railroad, and the vicinity of MW-7, the goal of the Tracer Investigation is to locate the edge of the plume (i.e., non-detection of VOCs in the Tracer Investigation) leading to the installation of a monitoring well. In the case of the vicinity of MW-6, the goal is to determine if contamination from the town of Griffith underground storage tanks has impacted MW-6. Additional details are provided in the QAPP and FSP.

The **sixth step** is to present results of Tracer Investigation of the Upper Aquifer to the Agencies in a Technical Memorandum, with proposed monitoring well locations. The **seventh step** is to install and sample wells as approved by the Agencies. The samples will be analyzed for the parameters required by Appendix B of the SOW, which will include a full scan for

VOCs, SVOCs, PCBs, and selected metals. The samples will be analyzed using CLP Methods at DQO Level IV. The additional wells will be installed to verify the extent of groundwater contamination. Based upon the available information, three Upper Aquifer wells are proposed at this time (MW25, MW26, and MW27) at locations shown on Figure 4-2. The proposed wells would be located at the limits of this previously identified VOC plume (i.e., non-detection of VOCs in the Tracer Investigation). The Upper Aquifer wells will be installed with 10-ft screens located at the top of the clay.

The **eighth step** is the presentation of the results to the Agencies with a proposed quarterly monitoring program in a Technical Memorandum. The **ninth step** is the sampling of wells on a quarterly basis as approved by the Agencies.

4.1.2 Lower Aquifer Investigation

The goals of the Lower Aquifer investigation are:

- Determine the stratigraphy of the Lower Aquifer
- Determine the Vertical Extent of VOC impacts in the Vicinity of MW-9 in the Lower Aquifer
- Determine if VOCs have reached the POC downgradient from MW-9, and if so determine their vertical concentration profile in the Lower Aquifer
- Determine the vertical gradients in the Lower Aquifer
- Determine if dense, non-aqueous liquids (DNAPLs) are present in the Lower Aquifer

The goals of determining the stratigraphy, the presence of DNAPLs, and the vertical and horizontal extent of VOCs in the Lower Aquifer will be accomplished with two vertical profile borings. Vertical profiling will consist of the collection of groundwater samples from temporary sampling points (e.g., a temporary well with a five-ft screen) installed on ten-ft centers as the boring is advanced to the base of the lower aquifer. Each vertical profile boring will utilize a protective casing keyed into the lower clay to minimize the potential for cross-contamination of the Lower Aquifer. The vertical profiling would not begin until the Perimeter Groundwater Containment System is operational and has met its gradient control Performance Standard, which will help minimize the potential for cross-contamination of the Lower Aquifer due to drilling through the clay confining layer in contaminated areas.

The first vertical profile boring will be drilled in the vicinity of monitoring well MW-9 is to determine the vertical distribution of VOCs in the Lower Aquifer and determine if DNAPL are present. It is anticipated that the VOC impacts in the Lower Aquifer will decrease with depth, and so a well (MW29)would be installed below the plume to monitor the vertical migration of the plume and obtain vertical gradient measurements.

The second vertical profile boring will be performed downgradient of MW-9 at the groundwater POC to: determine if VOCs are present in the Lower Aquifer at the POC; if VOCs are present, determine the vertical distribution of VOCs at the POC; and to determine if DNAPLs are present. It is anticipated that a well (MW30) would be installed at the depth at which the highest concentration of VOCs were detected. If VOCs are not detected, the well

would be installed at a depth approved by the U.S. EPA and IDEM to obtain vertical gradient measurements.

The stratigraphy of the Lower Aquifer will be determined by collecting split spoon samples on 2.5 ft centers to the base of the Lower Aquifer in the boring to be performed in the vicinity of MW-9 and the boring at the POC downgradient of MW-9. The samples will be logged in the field and three samples from each boring will be sent to the laboratory for grain-size analysis.
Water level data indicate that the six residential wells nearest to the Site (on Reder Road) are located upgradient of the Site. However, one additional Lower Aquifer well (MW28) is proposed to be located to the east of Colfax Road between these residential wells and the site (Figure 4-2) to provide additional data. The Lower Aquifer well will be double-cased through the Upper Aquifer and installed with a five-ft screen located five feet below the clay layer.

Additional details regarding vertical profiling and well installations are provided in the QAPP and FSP.

4.2 DETECTION/COMPLIANCE GROUNDWATER MONITORING

The Detection/Compliance Monitoring Program will be finalized after the completion of the Groundwater Extent Investigation described above. The goal of the Detection/Compliance Monitoring Program prior to construction and operation of the Perimeter Groundwater Containment System and the Remedial Design for the remaining groundwater components is to monitor the nature, character and extent of the ground water contamination plume. Based on the existing data, the monitoring wells selected to meet this goal include those located on the north, west, east and south boundaries of the site at upgradient, downgradient and transgradient locations and at locations within the site which have exhibited the highest concentrations of contamination. These Upper Aquifer wells are: MW3, MW4, MW16, MW25, MW13, MW26, MW11, MW27, MW12, MW17, MW18, and MW19 (Figure 4-3). The selected Lower Aquifer wells are MW9, MW29, MW30, MW10, MW8, MW7, and MW28, which are located at upgradient, downgradient and transgradient locations (Figure 4-3). The selection of these wells will be reviewed based on the new data generated during the groundwater investigation described in Section 4.1. Wells may be added or deleted from the list based on the new data.

The Upper and Lower Aquifer wells will be sampled on a quarterly basis. The samples will be analyzed for CLP Target VOCs at Level IV according to the QAPP and FSP (Table 4-2). Water level measurements of the entire water level monitoring network will be collected at each sampling event. It is anticipated that after a period of time, the sampling frequency may be reduced to semi-annually after approval of the U.S. EPA and IDEM.

Residential Well Monitoring
The goal of the residential well monitoring program is to determine if groundwater

contamination from the ACS site is impacting residential drinking water. Samples collected during the RI did not detect contamination of residential drinking water, consistent with the RI groundwater monitoring well results. IDEM sampled two water supply wells in September 1994 and analyzed the groundwater for metals, VOCs, SVOCs and pesticides and no impacts were found. The above described Detection/Compliance Groundwater Monitoring System will be used to determine the need for the collection of samples from nearby residential wells, and to determine which wells will be sampled.

The Detection/Compliance Groundwater Monitoring System results will be reviewed to determine if the Performance Standards listed in Appendix B of the SOW are exceeded. If Performance Standards are exceeded, then a plan to investigate the exceedance will be submitted to the U.S. EPA and IDEM within two weeks of sampling data validation. If constituents are detected that are not listed in Appendix B of the SOW, they will be evaluated to determine if they are present at a concentration that in combination with the other detection constituents, would exceed a cumulative risk of 1.3×10^{-5} cancer risk or a cumulative non-cancer risk of hazard index greater than unity as established in the ROD. If the detection of a non-Appendix B (SOW) constituent results in the exceedance of the ROD established levels, then an exceedance investigation plan will be submitted to the U.S. EPA and the IDEM.

The exceedance investigation plan will consider the parameters of concern, direction of groundwater flow, aquifer of concern, other potential sources for the exceedance and proximity of residential wells. The plan will present recommendations which may include retesting of selected monitoring wells for CLP VOCs, SVOCs, PCBs, or selected metals depending on the parameters of concern, additional groundwater investigations, or residential well sampling downgradient of the well where groundwater sample results indicate an exceedance of the Performance Standards.

If sampling of residential wells is conducted, the samples will be analyzed for CLP Target VOCs, SVOCs, PCBs, or selected metals at DQO Level IV using the CLP Statement of Work according to the QAPP and FSP (Table 4-2). The results will be provided to the U.S. EPA and the IDEM, who will determine if residential well closures or groundwater use advisories are indicated. The U.S. EPA and IDEM will be responsible for providing the results to the well owners/users. The results will be provided to the U.S. EPA within two weeks after completion of data validation. If groundwater use advisories or residential well closures are determined to be required, the Respondents will implement the following contingency plan.

Groundwater Use Advisories

Upon written notification from the U.S. EPA that groundwater use advisories are needed, the Respondents will take the following steps.

1. Prepare letters to be sent by U.S. EPA, IDEM or the County Health Department via certified mail to the residents identified by the U.S. EPA as subject to the Groundwater Use Advisory. The letters will include the reason for the advisory provided by the U.S. EPA, and the U.S. EPA designated public affairs contact person's name and phone number. These...

letters will be prepared for the residents identified by the U.S. EPA within two weeks of receipt of the U.S. EPA's complete written instructions.

2. Residences failing to receive the letter within two weeks, as determined by the return receipts, will be visited within one week with representative from U.S. EPA, IDEM or the County Health Department to provide the information in person. If no one answers the door, a message will be placed in the mail box (or taped to the door), and the visit documented in the files.

3. The U.S. EPA, IDEM and the County Health Department will be notified in writing of the residences that failed to receive the certified letter or could not be contacted in person, within 30 days of the initial notice.

Well Closures

A well closure is the cessation of use of a well for human consumption if the well does not have adequate treatment of the water prior to human consumption. Adequate treatment means meeting the Performance Standards for human consumption of water as described in the ROD. The Respondents may elect to provide treatment for wells found to be impacted by contaminants from the ACS site. This could include bottled water, or a new permanent water supply (or a combination of these responses). Upon written notification from the U.S. EPA that well closures are needed, the Respondents will take the following steps.

1. Determine which course of action to take to address the well closure(s) (i.e., treatment, bottled water, new permanent water supply or a combination thereof). It is anticipated that it will take approximately two weeks for the Respondents to select a course of action. The selected course of action will be presented the U.S. EPA and IDEM for approval.

2. Upon approval of the selected course of action by the U.S. EPA and IDEM, the Respondents will prepare letters to be sent by U.S. EPA, IDEM or the County Health Department via certified mail to the residents identified by the U.S. EPA as subject to well closures. The letters will be prepared within two weeks of the U.S. EPA's approval of the selected course of action. The letters will include:

- The reason for the closure as identified by the U.S. EPA
- An agreement to allow the Respondents to implement the well closure(to be signed and returned by the resident or the owner, whoever has the authority to provide access)
- A Respondents' designated contact person's name and phone number
- The U.S. EPA designated public affairs contact person's name and phone number.

3. Residences failing to receive the letter, as determined by the return receipts within two weeks, will be visited with representatives from U.S. EPA, IDEM or the County Health Department within one week to provide the information in person. If no one answers the door, a message will be placed in the mail box (or taped to the door), and the visit documented in the files.

4. The U.S. EPA , IDEM and the County Health Department will be notified in writing of the residences that failed to receive the certified letter, could not be contacted in person, or refused to provide written permission to the Respondents to implement the well closure, within 30 days of the initial notice.

5. Upon receipt of all of the signed agreements (exclusive of those identified in step 4), the Respondents will implement the well closure at the affected residences. The implementation will begin within two weeks of the receipt of the all of the signed agreements. The period required to complete the selected action will vary and will be approved by the U.S. EPA in step 1 above.

4.3 EVALUATION OF THE WETLANDS

Based upon the available RI data, the U.S. EPA identified potential risks to the wetlands in its ecological assessment of the ACS site (Final Ecological Risk Assessment for American Chemical Services, Griffith, Indiana, March 1992). The purpose of this wetlands investigation is to further define these potential impacts from the ACS site. The investigation will determine if elevated contaminant levels are widespread in order to decide whether toxicity testing and /or bioaccumulation studies should be performed. Potential impacts from the ACS site would be through groundwater discharge to surface water, or direct runoff from ACS plant site process areas. Surface water and soil sediment samples are proposed below, but the actual locations will be determined in the field.

The U.S. EPA Ecological Risk Assessment (ERA) for mink (the hypothetical wetlands inhabitant indicator species) stated that the contaminants that exceeded the hazard index of 1 were: benzene, 2-butanone, bis (2-chloroethyl) phthalate, heptachlor epoxide, PCBs, iron, lead, mercury and zinc, based upon site wide data (page 6-3 of the U.S. EPA ERA). According to the U.S. EPA ERA, the primary exposure route of benzene, 2-butanone, and bis (2-ethylhexyl) phthalate to mink is via ingestion of aquatic prey that bioconcentrate these contaminants from surface water. For iron, the primary exposure would be through direct ingestion of surface water by the mink. For lead, PCBs, mercury, and zinc, the exposure would be through ingestion of aquatic prey that bioconcentrate these contaminants from water and incidental ingestion of sediments. For heptachlor epoxide, the primary exposure would be through direct ingestion of sediments by the mink.

The U.S. EPA ERA for aquatic receptors (page 6-3 of the U.S. EPA ERA) indicates that surface water guidelines used by the U.S. EPA were exceeded for benzene, 2-butanone, chlorobenzene, diethylphthalate, bis (2-ethylhexyl) phthalate (BEHP), PCBs, cadmium, lead, mercury, zinc, cyanide, and iron. The U.S. EPA ERA indicated that sediment guidelines were exceeded for PCBs, BEHP, heptachlor epoxide, and PAHs, and arsenic, cadmium, chromium, copper, lead, and zinc.

The surface water and sediment sample parameters for this investigation were selected based upon the U.S. EPA finding that a specific constituent may pose a risk to wetland or aquatic

species, and if the constituent was actually detected in groundwater, surface water or sediment samples near the wetlands. Based upon this approach, surface water samples will be analyzed for VOCs, SVOCs, PCBs, zinc, cadmium, lead, iron, mercury, and cyanide (Table 4-2).

Using the above described approach, sediment samples would be analyzed for SVOCs, heptachlor epoxide, PCBs, arsenic, cadmium, chromium, copper, lead, mercury, and zinc, however, heptachlor epoxide was not detected in the RI wetlands sediment samples (SD03, SD04, SD11, SD12, and SD16) and therefore heptachlor epoxide will not be included in the parameter list. VOCs will be added to the parameter list because some of the samples will be collected in areas not previously studied (i.e., north of the On-Site Containment Area), and VOCs are a common contaminant at the ACS site. Therefore, the sediment sample parameter list will include VOCs, SVOCs, PCBs, arsenic, cadmium, chromium, copper, lead, mercury and zinc (Table 4-2).

Recently, Mr. James Tarpo of ACS indicated to Mr. William Bolen of the U.S. EPA that historically, there had been direct runoff to the north of the On-Site Containment Area, and so three soil/sediment sample locations are proposed to determine the presence or absence of impacts in this area (SD28, SD29, and SD30) (Figure 4-5). Other areas of potential runoff from the ACS plant site will also be sampled further including the vicinity of RI samples SD3, SD4, SD11, SD12 and SD16. Proposed sample locations are based upon topography, surface water routing, and past sampling results. These additional samples are SD17 through SD27, and the proposed locations are shown on Figure 4-5. One sample will be collected from the top six inches of soil/sediment at each location and submitted for laboratory analysis . The samples will be analyzed for VOCs, SVOCs, PCBs, arsenic, cadmium, chromium, copper, lead, mercury, and zinc at Level IV DQO using the CLP Statement of Work according to the QAPP and FSP (Table 4-2).

Surface water samples will be collected from the drainage ditch that runs on the north and west of the wetlands and a tributary (Figure 4-5). One surface water sample will be collected at an upstream location and four in downstream locations and from pooled water within the wetlands (i.e., the tributary). The upstream sample location will provide an indication of the quality of the surface water entering the ditch from offsite. Surface water samples from the ditch will provide an indication of the quality of the groundwater discharging to the wetlands, although such samples will also include potential effects from upstream influences and groundwater discharge from areas on the opposite site of the ditch from ACS. Samples will also be collected from standing water in the wetlands, if possible. Water samples of standing water in the wetlands would provide the best data to evaluate the potential impacts of groundwater discharge to the wetlands, and up to three such samples may be substituted for downstream ditch samples as conditions permit. Surface water samples will be analyzed for VOCs, SVOCs, PCBs, zinc, cadmium, lead, mercury, cyanide, and iron at Level IV DQO using CLP Statement of Work according to the QAPP and FSP (Table 4-2) .

Surface water and sediment samples will be collected from two locations in the cattail marsh near the area where the groundwater treatment effluent will be discharged (Figure 4-5). Surface water and sediment samples will also be collected from the ditch where the RI sample

SD7C was collected (Figure 4-5). The samples will be collected and analyzed as described above, and the actual locations will be determined in the field.

4.4 WELL ABANDONMENT

Monitoring well ATMW-4D, the two unused ACS water supply wells, and Griffith Landfill monitoring well MW-4D are proposed for abandonment. ATMW-4D is located west of the ACS plant area near the eastern boundary of the wetlands, and was installed by ATEC Associates Inc. for the ACS Site owners in a previous investigation. A letter from ATEC Associates, Inc. (May 2,1986) to Mr. Rundio, Attorney for ACS at that time, stated that the original well ATEC well ATMW-4D was replaced because grout was improperly placed around the well screen as indicated by high pH results. The well construction documentation for the replacement well is not available to us at this time, and so the well construction is not known.

Griffith Landfill well MW-4D is located near the northwest corner of the Offsite Area, between the Griffith landfill and the Offsite Area, and was installed by the owner/operators of the Griffith Municipal Landfill. The IDEM geologist overseeing the Griffith Landfill stated that he believed that well MW-4D is leaking based upon the water chemistry of samples from MW-4D. The chloride concentration in samples from the upgradient well MW-1D ranged from 41 to 56 mg/l, and the chloride concentration in the samples from well MW-4D ranged from 148 mg/l to 170 mg/l over the same time period. Chlorides are a conservative, non-reactive, non-degrading constituent of typical landfill leachate. Griffith Landfill leachate chloride concentrations ranged from 229 mg/l to 902 mg/l.

As discussed in Section 2, there are two unused ACS water supply wells screened to the Lower Aquifer. The well construction is not known and it is suspected that they were not double cased through the clay confining layer and could serve as a conduit for contamination from the Upper Aquifer to the Lower Aquifer.

None of the wells described above is part of the ACS NPL Site monitoring well network and will not be replaced. MW-4D is part of the Griffith Municipal Landfill Monitoring well network, and may require replacement. It appears that these Lower Aquifer monitoring wells have the potential to serve as conduits for migration of contamination to the Lower Aquifer. Additional Griffith Landfill wells screened in the Lower Aquifer will be proposed for abandonment if data indicate that they have the potential to serve as a contaminant transport pathway to the Lower Aquifer. Well abandonment will be performed following the State of Indiana regulations.

J:\4077\0030\WORK PL\VER 2\PRE DES\SEC4 FIN.WPD

5

PILOT/TREATABILITY TESTING

The Pre-Design pilot and treatability studies are needed to design the remedy for the ACS Site. The studies to be performed include:

- Soil ISVE pilot test
- Waste ISVE pilot test
- Pretreatment/material handling pilot test
- LTTT bench test

The pilot tests require a period of dewatering of the test area to represent full-scale conditions for the design due to the shallow water table at the Site (currently two to three feet below the surface in the On-Site areas). The design of the dewatering system will be prepared concurrent with the preparation of the Pilot/Treatability Testing QAPP Addendum. The effluent from the dewatering system will be directed to the Perimeter Groundwater Containment System treatment plant or collected in tank trucks and transported off-site for treatment. For additional information on effluent treatment, see the "Perimeter Groundwater Containment System RD/RA Work Plan".

The dewatering would occur for a period of approximately three to six months prior to conducting the treatability testing. The actual timing would depend on the effectiveness of the dewatering efforts as measured by a reduction in moisture content over time within the dewatered areas. The performance of the dewatering system will be measured using piezometers. The dewatering system would include a system of wells with the extracted water treated in the Perimeter Groundwater Containment System treatment plant or collected in tank trucks and transported off-site for treatment. The design of each dewatering system and the development of associated pilot test detailed work plan/QAPP addendums would begin upon approval of the Pre-Design Work Plan as described in Section 6-Schedule.

Dewatering is important to the Remedial Design for many reasons including:

- During full scale operation, water that is collected from the ISVE systems will have to be treated, so it is important to understand what volumes of water can be anticipated, and the chemical characteristics of the water for wastewater treatment purposes.

- The highest levels of contaminants in the soils in the On-Site areas are typically in the range of five to ten feet deep, so lowering the water table will allow the test to be conducted in the areas of highest contamination for proper design of the offgas treatment system

- The wastes are water saturated, and will have to be dewatered to permit air flow during ISVE pilot testing.

- The wastes at the Site contain significant levels of VOCs. It is critical to understand what the concentrations of VOCs in the ISVE offgas will be so that an effective, safe treatment system can be designed (there have been examples at other sites where an improper understanding of offgas characteristics has resulting in explosions in the offgas treatment system).

- The wastes contain large amounts of debris and other materials (paper, wood, cloth, etc.). These materials are currently below the water table and must be dewatered prior to LTTT. Because the effectiveness and cost of LTTT are very sensitive to water content, it is important to understand what the water content of the wastes will be after dewatering. If the water content is high, the volume of condensate, which may have to be transported off-site for treatment, will also be high. This could impact the type of LTTT unit that would be used at the Site or the method of condensate or offgas treatment.

- It is also important to have the material handling test be conducted in a dewatered area because fugitive VOC and airborne particulate emissions, which must be controlled or collected and treated, will be highest after the wastes are dewatered.

5.1 ISVE/BIOVENTING PILOT STUDIES

The primary soil ISVE/bioventing test will be conducted in the On-Site Containment Area because the soil type (i.e., sand) and the type and amount of contamination are representative of site conditions (Figure 5-1). The waste ISVE pilot test would be conducted in the On-Site Waste Area, i.e., the Still Bottoms/Treatment Lagoon Area, as this is the location specified in the ROD (Figure 5-2).

The ISVE/bioventing pilot studies would consist of a series of tests performed to obtain information required to optimize the design and operation of a full-scale system. Bench scale ISVE and bioventing treatability studies on ACS Site soils have demonstrated that these technologies have the potential to achieve the clean-up levels. These studies were conducted

during the good faith negotiating period in 1992. The scope of the studies were discussed with U.S. EPA and IDEM, however, the Work Plans were not formally approved by the U.S. EPA or the IDEM. Data from the soil and waste area pilot studies would be used to evaluate the following:

- The optimum air flow rate necessary to maximize contaminant removal while minimizing energy requirements
- The radius of influence of each individual recovery well
- Contaminant removal rates in order to estimate requirements for a volatile organic compound (VOC) air emissions permit, and design the air treatment system
- The influence of buried waste, drum remnants, and other garbage and debris on air flow paths and extraction well radius of influence (waste area test)
- The potential implications of the non-homogeneity of waste present and VOC soil concentrations on the overall operation of the ISVE/bioventing system (e.g., uniform air contract, total VOC air emissions, etc.)
- The effect of varying extraction well flow rates on contaminant removal rates and system energy requirements
- The influence of ISVE on groundwater surface elevation, and its resulting impact on the screening interval length available to uniformly influence the entire depth of the exposed vadose zone
- The enhancement of naturally occurring biological activity that will occur as the result of introducing a constant source of oxygen through air flow (this bioventing component of the process is critical in the treatment of the SVOCs

Outline of ISVE/Bioventing Studies

The ISVE/bioventing pilot studies will consist of a total of two extraction wells (EW1, and EW2) and 17 gas probe nests (GP1 through GP12). The proposed layout of the pilot study system is presented in Figure 5-5. Typical schematics for the extraction well and gas probe construction are presented as Figures 5-3 and 5-4.

Extraction well EW1 will be located in the Still Bottoms Pond Area, along with 6 gas probe nests (GP1 through GP6). The ISVE/bioventing pilot study for the On-Site wastes will be conducted in this area. The Still Bottoms Area has been selected for the On-Site wastes pilot study based on the frequency of samples collected in this area which meet the criteria of wastes, as well as the history of free liquids disposal which occurred in this area. The locations of the Still Bottoms Area waste ISVE gas probes were determined based upon the expected permeability of the materials being investigated. Extraction well EW2 will be located in the On-Site Containment Area, along with six gas probe nests (GP7 through GP12), and will be used to conduct the pilot study for contaminated soils.

Based on the RI data, as well as the anticipated level of drawdown which will be realized by the dewatering system, the extraction wells will be installed to a depth of approximately 15 feet. The actual depths of the extraction wells will be based on a determination of the depth to the water table in the field. The pilot studies will be performed in two phases. The first phase will involve the installation of extraction well EW1, which will be nested and consist of two extraction wells screened at different intervals. "Optimization" and "Screened Intervals Effects" tests, will be conducted on both nested wells in order to select the screening interval to be used for the remaining extraction wells. The installation of extraction well EW2 will then follow as a second phase to the pilot studies.

The gas probe nests are used to measure pressure gradients caused by the induced air flow to the extraction well(s). They will also be used to collect data for respirometer tests. The effect of subsurface non-homogeneities on air flow paths and the radius of influence with depth due to varying soil types or waste and debris presence will be determined through the use of monitoring nests installed in different radial directions from the extraction wells.

Prior to conducting the pilot studies, the IDEM will be consulted regarding the applicability of air emission regulations and the need to include air treatment during the pilot studies. If air treatment is required, the blower exhaust will be connected to two, 55-gallon activated carbon canisters in series for the full duration of the pilot studies. Based on the composition and exhaust concentrations measured during the pilot studies, a decision may be made during the Remedial Design phase to evaluate alternative and innovative methods of air treatment for this site. A separate pilot study protocol will be developed, if needed which would incorporate the proposed pilot study system discussed in this section, for any alternative or innovative method of air treatment which may be selected for future evaluation at the site.

An outline of the pilot studies layout and more detailed protocol is presented in Appendix A. An ISVE Test well schematic is provided in Figure 5-3, and typical ISVE Monitoring Probe nest is shown in Figure 5-4. The ISVE Test Well and Monitoring Probe layout is shown in Figure 5-5. The type of tests and parameters to be evaluated that would be included in the ISVE/bioventing pilot study for the soil and waste areas include the following:

Optimization Tests - Short duration optimization tests, approximately two hours each, would be conducted by operating each pilot study extraction well at three individual flow rates for a sufficient period to allow stabilization of the vacuum readings at the individual gas probes. The purpose of these tests is to establish a vacuum/air flow rate relationship for design purposes, and to determine an optimum air flow rate combination(s) to be used in the full-scale design (i.e., the point at which VOC concentrations in the exhaust air are becoming diluted or a maximum practical air flow rate is achieved). Gas probe nests would be installed to allow an evaluation of air flow paths, surface recharge, and blockages of subsurface air flow due to waste and debris presence. Gas probes are also used to take measurements of biological activity on a localized basis. Groundwater levels are measured to evaluate the magnitude of upwelling created by the vacuum.

The optimization tests for individual extraction wells will involve varying the air flow rate between 20 and 100 cubic feet per minute (cfm). Each extraction well will be operated at a minimum of three air flow rates selected based on field observations. It is anticipated that the optimization tests will be run at air flow rates of 20, 50, and 100 cfm. A variable speed positive displacement blower, designed to operate at a constant air flow rate, will be used for the pilot

study. The blower will be of intrinsically safe construction with an explosion-proof motor for safety considerations. VOC removal would be measured using a combination of field techniques and sampling for laboratory analysis. One air sample per pilot study extraction well (approximately six to twelve total) would be collected for laboratory analysis during the optimization tests for quantification purposes. Refer to the discussions for the "Extended System Operation" test for more detail on the proposed sampling and measurement methodologies.

Biological Activity - Bioventing has been proposed as a mechanism for reducing SVOCs to meet applicable cleanup levels. The constant supply of oxygen created as a result of air flow during ISVE operation has been found to enhance naturally occurring biological activity. As such, the terms ISVE and bioventing can be used interchangeably to some degree. The subtle difference between the two technologies is in the setting of the extraction well air flow rates to either emphasize removal by volatilization (VOC removal rate is faster at higher air flow rates for ISVE) or biodegradation (VOC removal rate through biodegradation is slower at lower air flow rates in bioventing). It should be recognized that removal is occurring concurrently by volatilization or biodegradation at whatever design air flow rates are ultimately selected. For the ACS Site, the occurrence of enhanced biological activity during ISVE operation allows for the treatment of SVOCs which are less amenable to removal by volatilization.

The ISVE/bioventing pilot study protocol would include measurements of biological activity. Six to ten soil samples will be collected from each pilot study waste and soil area (approximately 25 samples total) during the installation of the pilot study extraction wells for analysis for parameters useful in establishing a baseline for evaluating enhanced biological activity. These parameters would include VOC and SVOC soil concentrations, nutrient and moisture levels, total and degrader bacterial plate count data, and geotechnical parameters (Table 5-1). Analyses will be conducted at DQO Level III using SW846 methods, ASTM methods, etc. Oxygen and carbon dioxide concentrations would be measured using field instrumentation during each pilot study test. DQO Level III was selected for laboratory testing because the data will be used for engineering purposes. Data from the extended operation test (see discussion below) would be used to establish a trend for enhanced biological activity occurring during operation.

A respirometer test would be performed at the start and completion of the extended system operation test (see discussion below) in each of the test areas. A respirometer test is current state-of-the-art for evaluating bioventing systems, and involves the monitoring of oxygen depletion rates due to biological activity across the treatment area following system shutdown. Results from these respirometer tests would be used to determine if enhanced biological activity is occurring during operation of the ISVE/bioventing system, which would have the long-term effect of reducing SVOC concentrations over time. Oxygen and carbon dioxide levels would be periodically measured (approximately every one to two days) at each gas probe and extraction well using field instrumentation for the duration of the test. A respirometer test typically lasts two to three weeks, until oxygen levels have stabilized.

Screened Interval Effects - Given the of presence of waste and debris (waste area test), the potential for short-circuiting from the surface, and the presence of elevated contaminant concentrations at shallow depths, the extraction well screening interval which is selected can

have a dramatic effect on removal effectiveness. Both a shorter and longer screening interval will be tested during the pilot study. This would be accomplished by installing one well nest in selected pilot study areas, consisting of two wells screened at different intervals. This side-by-side installation would allow for the evaluation of screen length impact on air flow paths, short-circuiting from the surface, and overall VOC removal rates.

Extended System Operation - Extraction wells installed in the waste pilot study area would be allowed to continuously run for an extended period. The extraction wells would be operated concurrently. An extended system operation test lasts for a minimum of eight weeks, but no longer than it takes to implement treatment for source materials in the Off-Site Area, dependent on field observations. Extraction wells are run continuously until enough data has been collected for design purposes, and the system operating parameters have satisfactorily stabilized with time. Air flow, VOC removal, and biological activity data would be collected over this period of time. The extended system operation test would allow for the evaluation of performance following the removal of multiple air flow volumes and disruption of initial equilibrium conditions. Of particular concern is the impact of continuous operation on air flow paths, potential well plugging due to waste presence, and VOC removal rates. VOC removal rates measured during extended system operation are more representative for air treatment system design than those measured during short duration tests. Extended system operation is also necessary to evaluate enhanced biological activity and perform a meaningful bioventing respirometer test.

During the extended operation test, Site visits would be performed every day for the first three to five days and once a week, thereafter, for the duration of the test. The frequency of Site visits may be varied based on field observations. Required field measurements and sampling events are completed during the Site visits. VOC removal would be measured using a combination of field techniques and sampling for laboratory analysis.

Field techniques that would be used to measure VOC removal include use of a photoionization detector (PID) and colorimetric tubes. Field measurements for VOCs are performed for comparative purposes, provide immediate feedback in the field, and allow for frequent measurements at individual extraction wells and gas probes. Air sampling for laboratory analysis, using EPA Method TO14, would be performed at the individual extraction wells at the startup of the extended operation test, and once a week thereafter for the duration of the test (approximately 15 to 25 total). Laboratory results would be used to quantify VOC emissions and confirm the comparative results generated by the field measurements. Air flow paths and system influence would be inferred by taking vacuum measurements at the individual gas probes using magnehelic gauges. In-line rotameters would be used to measure extraction well air flow rates. Oxygen and carbon dioxide measurements would be taken at gas probes and extraction wells during each Site visit to monitor trends in biological activity.

Non-homogeneity of Contaminant Distribution - Two individual wells would be installed in the waste pilot study area to evaluate the impact of the non-homogeneity of waste and soil contaminant distribution on potential ISVE/bioventing performance. Because of this non-

homogeneity and the large area requiring treatment, multiple test wells will be installed to provide more representative coverage. A larger coverage area would provide, among other things, a better estimate of VOC removal rates for air treatment design, and a more comprehensive evaluation of the impacts of subsurface waste and debris presence on air flow paths and removal effectiveness (i.e. ability to achieve uniform air flow and contact with contaminants). The pilot study extraction wells will ultimately be incorporated into the full-scale installation.

The potential for ISVE/bioventing treatment to meet the VOC and SVOC cleanup levels in the waste area will be based on the following data from the pilot study at the completion of the Extended System Operation period (defined above):

- Gas probe vacuum measurements and extraction well monitoring data would be used to demonstrate that air flow is being induced within necessary areas and depths requiring treatment, and that effective VOC removal is occurring. As long as air flow is contacting the required areas (i.e., subsurface obstructions and well plugging are not a major problem), VOC soil concentrations would continue to decrease and the cleanup standards achieved given a sufficient time of operation. The constant air flow would also provide the oxygen necessary for enhanced biological degradation of the SVOCs to achieve cleanup levels with sufficient time of operation.

- Biological activity measurements taken during the pilot study and respirometer tests, would be used to determine if enhanced in-situ biological activity (i.e., bioventing) is occurring. Oxygen depletion rates would be calculated from respirometer test data to extrapolate the magnitude of in-situ biological activity. As long as evidence of enhanced in-situ biological activity is occurring, VOC and SVOC removal by this mechanism is viable, and cleanup levels would be achieved with sufficient time of operation.

A QAPP addendum will be prepared after approval of the Pre-Design Work Plan as requested by the U.S. EPA. The QAPP Addendum will include an Addendum to the QAPP, a FSP, and and Addendum to the SSP. The QAPP and FSP Addendum will provide the field and laboratory analytical methods/SOPs, detection limits, QC requirements, the field sampling procedures and SOPs, the frequency of monitoring, and number of samples.

5.2 PRETREATMENT/MATERIAL HANDLING

There are a number of technical issues that must be addressed in order to develop a workable design for the excavation of buried waste and material handling. These issues include:

- Type and quantity of debris at the Site
- Ability of conventional materials handling equipment to separate debris from materials that can be thermally treated

- Potential for fugitive VOC emissions during material handling operations.
- Types and concentrations of organic contaminants in Site soils/sediments

Soil borings from previous Site investigations conducted by Montgomery Watson indicated that a large quantity and wide variety of types of contaminated debris are present at the ACS Site. This issue has the potential for a significant impact on remedy design. If the debris cannot be efficiently separated from the contaminated soils and sediments, the debris can impact the overall effectiveness of a thermal desorption unit:

- Jamming of mechanical equipment, resulting in excessive downtime
- Inability to adequately decontaminate organic debris
- High consumption rate of activated carbon in offgas treatment and water treatment systems
- Potentially high stack emissions resulting from treating material with a high organic fraction.

The locations for the test pits will be in the area shown on Figure 5-6. Five test pits will be excavated and approximately 100 tons of material will be removed from each test pit. Only one of the five test pits will be dewatered. Material excavated from test pits will be brought to a central test Site and processed (Figure 5-6).

Execution of the pretreatment and material handling study (PMHS) will require full-scale material handling equipment to determine the ability to separate debris from the soil. The equipment will be specified to accomplish the following separations: (1) coarse screening (6" grizzly); (2) medium screening (2" vibrating power screen); (3) fine screening (3/4" vibrating power screen), and (4) a pug mill.

A high lift front end loader will be used to move material onto the grizzly. The classified waste streams generated by the operation will be collected, segregated by type of debris, and weighed to determine the quantity of each type of debris. The material passing the screening equipment will be visually examined to determine its debris content. Material which is processed will be segregated and stored in a secure area or replaced into the excavations. Debris will be evaluated as a characteristically hazardous waste under the debris rule in 40 CFR Part 268.45 (treatment standards for hazardous debris). This will include testing of five samples to determine if the debris exhibits the characteristics of hazardous waste: ignitability, corrosivity, reactivity, and Toxicity Characteristic (40 CFR 261.21, 261.22, 261.23, and 261.24).

During both test pit excavation and screening activities, daily ambient air samples will be collected upwind and downwind of the material handling activities. Air samples will be collected using summa canisters with a flow restricting orifice for the collection of daily samples (i.e., up to eight hour sample collection duration). This is effectively continuous air sampling. Meteorological data will be recorded concurrently with sample collection activities. This data will be used to estimate VOC emissions from the material handling activities.

The FSP and QAPP for the treatability study will include the following sections:

- Sample collection procedures
- Sample transportation
- Feed sample storage
- Data collection and reduction (QA/QC)

After completion of the testing, a test report will be prepared and included in the Pre-Design Report to document the data and conclusions from the test. The Pre-Design report will include the following sections:

- Introduction
- Description of test equipment
- Description of test materials
- Test protocol
- Waste stream characterization
- Recommendations and conclusions.

5.3 THERMAL TREATMENT TREATABILITY STUDIES

The Montgomery Watson project team has previously conducted a bench-scale thermal desorption treatability test for samples from the ACS Site. These studies were conducted during the good faith negotiating period in 1992. The scope of the studies were discussed with U.S. EPA and IDEM, however, the Work Plans were not formally approved by the U.S. EPA or the IDEM. The results of this study are documented in a report titled: "*Bench-scale Treatability Study - SoilTech Anaerobic Thermal Process, American Chemical Service NPL Site, Griffith, Indiana, April 1993.*" This study was conducted specifically to evaluate the ability of the Soiltech technology to remediate wastes at the Site. Therefore, the results are not universally applicable to other types of thermal desorption systems. However, the results from this study have been considered in making recommendations for further thermal desorption treatability testing.

Treatability testing is normally conducted using a tiered approach. The first test tier (laboratory-scale) includes relatively simple tray tests to define soil treatment-time and temperature operating conditions required to meet Site cleanup objectives. Tier 1 tests generally require 50 to 100 grams of material per test. Information from Tier 1 testing is used for establishing process setpoints for more sophisticated Tier 2 and Tier 3 testing (if required).

Tier 2 consists of a limited number of bench-scale tests using a rotary thermal apparatus (RTA) which closely simulates the physical environment inside of a full-scale thermal treatment device. Tier 2 tests will be used to (1) confirm treatment conditions required to meet soil cleanup objectives; (2) gather information to perform a material balance on other parameters of concern

(metals, organic carbon, sulfur, etc.); and, (3) gather data on stack emissions. Tier 2 testing requires approximately 500 to 1,000 grams of material per test condition.

Tier 3 testing is conducted using pilot-scale equipment. A number of thermal treatment contractors operate pilot-scale thermal desorption systems that can be used for performing larger scale treatability tests. Tier 3 tests are conducted at a scale of 40 to 800 pounds per hour. Tier 3 testing is not anticipated at this time. The decision not to conduct pilot-scale testing will be re-evaluated after the completion of the materials handling and Tier 1 and Tier 2 tests.

The overall objective of the thermal desorption treatability test program is to determine if thermal desorption will meet the clean-up levels for the ACS Site. The specific objectives of the thermal treatability test program include:

- Determine soil treatment conditions (soil temperature and residence time at temperature) required to meet cleanup objectives.
- Determine total metals balance in the feed and treated soils.
- Determine the concentration of metals in the TCLP extract from the feed and treated soils.
- Characterize offgas from a recovery type thermal desorption system using continuous emissions monitors (CO, CO_2, O_2, THC).
- Determine soil geotechnical properties to define material handling requirements.
- Evaluate the effect of treatment conditions on small pieces of debris (wood, rubber, paper, plastic, etc.).

Selection of representative soil feed samples for testing is a critical component of the overall program. Representative samples are required for generating test results to evaluate the effectiveness of the thermal process and can aid in the evaluation of scale-up issues. There are five primary waste characteristics that are important for evaluating the effectiveness of a thermal process, including:

- Clay and silt content and types
- Contaminant types and concentrations
- Organic content
- Moisture content
- Debris content and type.

Field screening techniques will be used to determine the relative concentrations of contaminants at various sampling locations. Eight samples will be collected in the field and analyzed to

After the test samples have been determined to be homogeneous, the soil matrices will be sampled and analyzed on a normal turnaround time for various chemical, physical and geotechnical properties including:

- Volatile organic compounds - SW-846 Method 8240
- Semi-volatile organic compounds - SW-846 Method 8270
- PCBs - SW-846 Method 8080
- Total metals - SW-846 Method 6010/7000 series
- TCLP metals - SW-846 Method 1311 followed by Method 6010/7000 series.
- Dioxins/furans (expressed total tetera through octa congeners and as 2,3,7,8-tetrachlorodibenzo para-dioxin toxicity equivalency factor, TCDD-TEF) - SW-846 Method 8290.
- Miscellaneous chemical properties (i.e., total chlorine/chloride, carbon, hydrogen, sulfur, nitrogen, phosphorus, sodium, potassium, moisture, ash, soil pH, total organic carbon (TOC), and heating value).
- Miscellaneous geotechnical properties (i.e., Proctor density, particle size distribution, soil classification, Atterberg limits, and unconfined compressive strength).

The results of these analyses will provide the baseline soil characterization for comparison with the treated soil analyses from the tray and RTA tests to determine the effectiveness of the thermal desorption technology.

Tray Testing (Laboratory-scale Tests)

The first testing tier will consist of static tray testing in a muffle furnace. Results of the tray tests will be used to select the optimum set of treatment conditions (temperature and residence time) for each soil matrix and to establish operating conditions for conducting the RTA testing.

A two by two test matrix (2 different temperatures, 2 different soil residence times) will be conducted on each soil sample. The range of soil treatment temperatures and soil residence times comprising the test matrix will be selected based on experience with similar contaminants and based on data from the previous study conducted by Montgomery Watson. Based on the results of previous studies, the optimum soil treatment temperature is projected to be in the range of 800 °F to 1,000 °F at a total soil residence time of 20 to 40 minutes. Analyses will be conducted on a fast turnaround to minimize sample holding time.

RTA Testing (Bench-scale Tests)

The second testing tier will be a bench-scale test using a RTA. This device can process a one kilogram charge of material and heat it through a time/temperature profile closely resembling

the conditions that will exist in a full scale thermal treatment system. One RTA test will be conducted per soil matrix.

The treated soil from the RTA tests will be analyzed on a normal turnaround for the following:

- Volatile organic compounds - SW-846 Method 8240
- Semi-volatile organic compounds - SW-846 Method 8270
- PCBs - SW-846 Method 8080
- Total metals - SW-846 Method 6010/7000 series
- TCLP metals - SW-846 Method 1311 followed by Method 6010/7000 series.
- Dioxins/furans (expressed total tetera through octa congeners and as 2,3,7,8-tetrachlorodibenzo para-dioxin toxicity equivalency factor, TCDD-TEF) - SW-846 Method 8290.
- Miscellaneous chemical properties (i.e., total chlorine/chloride, sulfur, and total organic carbon).

The results from these analyses will be compared to the results from the starting test soil to evaluate the effectiveness of the technology at the chosen treatment conditions.

The RTA offgas will be treated using a heated filter, a set of water impingers, and an activated carbon column. The offgas will be reheated prior to entering the activated carbon bed. An XAD resin trap will be used to collect PCBs and semivolatile organic contaminants of concern that pass through the activated carbon filter. A continuous emissions analyzer will pull a sample from the outlet of the activated carbon bed and analyze it for various gaseous compounds (CO, CO_2, O_2, THC). Grab samples of carbon filter offgas will also be taken at selected soil temperature intervals and analyzed for light hydrocarbons such as methane, ethane, propane, hydrogen, etc. The impinger water and XAD resin will be analyzed for PCBs and the organic contaminants of concern.

Debris Tests

The third soil matrix containing a mixture of debris and soil will be processed at one set of tray test conditions. However, only qualitative observations will be made for the residue remaining after each test with specific attention placed on the condition of the debris. One RTA test run will be conducted for the soil matrix containing the debris. The same analyses and offgas monitoring will be conducted on this test as will be conducted on the other RTA tests.

A treatability study report will be prepared and included in the Pre-Design report that will describe the thermal treatment treatability testing methods and equipment, summarize the results of the testing, and evaluate and discuss the test results with respect to potential

remediation equipment that could accomplish the remediation. The sections of the treatability test report will include:

- Executive Summary
- Introduction
- Feed Soil Characterization
- Screening Tests (Static Tray Tests)
- Bench Scale Tests (RTA Tests)
- Geotechnical Tests
- Technology Application
- Conclusions and Recommendations.

J:\4077\0030\WORK PL\VER 2\PRE DES\SEC5 FIN.WPD

6

SCHEDULE/DELIVERABLES

The Pre-Design Activities schedule is provided as a separate document and has been prepared in accordance with the UAO .

The deliverables required by this Work Plan are:

1. Tracer Investigation Points Proposal Memorandum
2. Tracer Investigation Technical Memorandum
3. Quarterly Monitoring Finalization Memorandum
4. Draft Pilot/Treatability Testing QAPP Addendum/Dewater Design
5. Final Pilot/Treatability Testing QAPP Addendum/Dewater Design
6. Draft Pre-Design Report
7. Final Pre-Design Report
8. Detection/Compliance Monitoring Report(s)

J:\4077\0030\WORK_PL\VER_2\PRE_DES\SEC6_FIN.WPD

TABLE 2-1
Summary of Detected VOCs
Expedited Groundwater Sampling
December 30, 1994 through January 5, 1995
American Chemical Service, Inc.
Griffith, Indiana

Sample #	Date Sampled	Vinyl Chloride	Chloroethane	Acetone	1,1-Dichloroethane	1,2-Dichloroethene	Chloroform	1,2-Dichloroethane	2-Butanone	Trichloroethene	Benzene	4-Methyl-2-pentanon	Tetrachloroethene	Toluene	Chlorobenzene	Ethylbezene	Xylenes	Tetrahydrofuran
GRIFFITH LANDFILL MONITORING WELLS																		
MW04D*	26-Jan-95																	
MW04S*	25-Jan-95		1300			37					570	63						3800
TRIP BLANKS AND FIELD BLANKS																		
TB01-01*	25-Jan-95																	
TB01-01	30-Dec-94																	
TB02-01	3-Jan-95			14			1											
TB03-01	4-Jan-95																	
TB04-01	5-Jan-95																	
FB01-01	30-Dec-94							2										
FB02-01	3-Jan-95																	
FB03-01	5-Jan-95																	
UPPER AQUIFER MONITORING WELLS																		
MW03-01	30-Dec-94		970								27000					690	750	
MW04-01	30-Dec-94		66								120							
MW05-01	30-Dec-94	16	26		26	14					350	6		6	34	3	83	
MW06-01	30-Dec-94		530								3000					770	3900	
MW11-01	3-Jan-95																	
MW12-01	3-Jan-95		2								2				4			
MW13-01	4-Jan-95		770															
MW14-01	4-Jan-95		660	47		24					440							
MW15-01	5-Jan-95										2							
MW16-01	4-Jan-95		3100	7700		140			15000		2000	14000						
MW17-01	30-Dec-94	2				9				1			4			2		
MW18-01	30-Dec-94																	
MW19-01	30-Dec-94		22								2							
MW20-01	30-Dec-94		79								14							
LOWER AQUIFER MONITORING WELLS																		
MW07-01	3-Jan-95																	
MW07-91	3-Jan-95								1									
MW08-01	30-Dec-94																	
MW09-01	4-Jan-95		650								40							
MW10-01	4-Jan-95											9						
MW21-01	4-Jan-95																	
MW21-91	4-Jan-95																	
MW22-01	30-Dec-94																	
MW22-91	30-Dec-94																	
MW23-01	5-Jan-95																	
MW24-01	4-Jan-95																	

Notes:

* - Indicates split samples collected from Griffith Landfill monitoring wells

All results reported in micrograms per liter (ug/L)

Table 2-2
Summary of Detected SVOCs
Expedited Groundwater Sampling
December 30, 1994 through January 5, 1995
American Chemical Service, Inc.
Griffith, Indiana

Sample #	Date Sampled	Phenol	bis(2-Chloroethyl) ether	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,2-Dichlorobenzene	bis(2-Chloroisopropyl)ether	4-Methylphenol	Isophorone	2,4-Dimethylphenol	Naphthalene	4-Chloro-3-methylphenol	2-Methylnaphthalene	Diethylphthalate	Di-n-butylphthalate	Di-n-octyl Phthalate
FIELD BLANKS																
FB01-01	30-Dec-94															
FB02-01	3-Jan-95															
FB03-01	5-Jan-95															
UPPER AQUIFER MONITORING WELLS																
MW03-01	30-Dec-94		120			51				5	2	9		6		
MW04-01	30-Dec-94															
MW05-01	30-Dec-94			2	7	18	34	2			2					21
MW06-01	30-Dec-94	64	43						7	58						47
MW11-01	3-Jan-95															
MW12-01	3-Jan-95						150									
MW13-01	4-Jan-95															
MW14-01	4-Jan-95		20													
MW15-01	5-Jan-95															
MW16-01	4-Jan-95		160					560		45						
MW17-01	30-Dec-94					3					2		24		2	
MW18-01	30-Dec-94															
MW19-01	30-Dec-95		12				2								1	
MW20-01	30-Dec-94		18													
LOWER AQUIFER MONITORING WELLS																
MW07-01	3-Jan-95															
MW07-91	3-Jan-95															
MW08-01	30-Dec-94															
MW09-01	4-Jan-95		23													
MW10-01	4-Jan-95															
MW21-01	4-Jan-95															11
MW21-91	4-Jan-95															9
MW22-01	30-Dec-94															
MW22-91	30-Dec-94															
MW23-01	5-Jan-95															
MW24-01	4-Jan-95															1

Notes:
All results reported in micrograms per liter (ug/L)

TABLE 2-3
Summary of Detected Metals
Expedited Groundwater Sampling
December 30, 1994 through January 5, 1995
American Chemical Service, Inc.
Griffith, Indiana

Sample #	Date Sampled	Arsenic	Manganese	Thallium
FIELD BLANKS				
FB01-01	30-Dec-94			
FB01-01 (F)	30-Dec-94			
FB02-01	3-Jan-95			
FB02-01 (F)	3-Jan-95			
FB03-01	5-Jan-95			
FB03-01 (F)	5-Jan-95			
UPPER AQUIFER MONITORING WELLS				
MW03-01	30-Dec-94	45.7	598	
MW03-01 (F)	30-Dec-94	43.3	525	1.2
MW04-01	30-Dec-94	16.1	3890	3.6
MW04-01 (F)	30-Dec-94	2.7	2260	
MW05-01	30-Dec-94	57.1	3250	1.1
MW05-01 (F)	30-Dec-94	25.5	2480	
MW06-01	30-Dec-94	105	889	
MW06-01 (F)	30-Dec-94	71	147	
MW11-01	3-Jan-95	10.9	253	
MW11-01 (F)	3-Jan-95		204	
MW12-01	3-Jan-95	4.3	1430	
MW12-01 (F)	3-Jan-95	1.1	1410	
MW13-01	4-Jan-95	2.5	996	
MW13-01 (F)	4-Jan-95		713	
MW14-01	4-Jan-95	25.3	1400	
MW14-01 (F)	4-Jan-95	2.5	582	
MW15-01	5-Jan-95	40.1	1000	
MW15-01 (F)	5-Jan-95	35.7	123	1
MW16-01	4-Jan-95	16.1	1010	
MW16-01 (F)	4-Jan-95	11.8	649	2.5
MW17-01	30-Dec-94	2.7	640	
MW17-01 (F)	30-Dec-94	1.4	654	
MW18-01	30-Dec-94		441	
MW18-01 (F)	30-Dec-94			
MW19-01	30-Dec-94	17.4	317	1.9
MW19-01 (F)	30-Dec-94	16	223	
MW20-01	30-Dec-94	5	1170	1.5
MW20-01 (F)	30-Dec-94	4.9	1040	

Notes:

All results reported in micrograms per liter (ug/L).

(F) - indicates a filtered sample, and results are representative of the dissolved metals concentration in groundwater sample.

Sample #	Date Sampled	Arsenic	Manganese	Thallium
LOWER AQUIFER MONITORING WELLS				
MW07-01	3-Jan-95		167	
MW07-01 (F)	3-Jan-95		153	
MW07-91	3-Jan-95	1.3	189	
MW07-91 (F)	3-Jan-95		106	
MW08-01	30-Dec-94	3.6	149	
MW08-01 (F)	30-Dec-94	3.4	121	
MW09-01	4-Jan-95	20.8	814	
MW09-01 (F)	4-Jan-95	2.9	165	
MW10-01	4-Jan-95		72	
MW10-01 (F)	4-Jan-95		60	
MW21-01	4-Jan-95	1.7	200	
MW21-01 (F)	4-Jan-95		188	
MW21-91	4-Jan-95	1.8	205	
MW21-91 (F)	4-Jan-95	1.4	182	
MW22-01	30-Dec-94	2.4	106	
MW22-01 (F)	30-Dec-94	3.6	106	
MW22-91	30-Dec-94	2.3	103	
MW22-91 (F)	30-Dec-94	4	109	
MW23-01	5-Jan-95	2.8	311	
MW23-01 (F)	5-Jan-95		206	
MW24-01	4-Jan-95	22.5	1670	1.8
MW24-01 (F)	4-Jan-95		260	

Notes:

All results reported in micrograms per liter (ug/L).

(F) - indicates a filtered sample, and results are representative of the dissolved metals concentration in groundwater sample.

TABLE 2-4
Summary of Detected PCBs
Expedited Groundwater Sampling Results
December 30, 1994 thru January 5, 1995
American Chemical Service, Inc.
Griffith, Indiana

Sample #	Date Sampled	Aroclor-1248
FIELD BLANKS		
FB01-01	30-Dec-94	
FB02-01	3-Jan-95	
FB03-01	5-Jan-95	
UPPER AQUIFER MONITORING WELLS		
MW03-01	30-Dec-94	
MW04-01	30-Dec-94	1.4
MW05-01	30-Dec-94	
MW06-01	30-Dec-94	
MW11-01	3-Jan-95	
MW12-01	3-Jan-95	
MW13-01	4-Jan-95	
MW14-01	4-Jan-95	
MW15-01	5-Jan-95	
MW16-01	4-Jan-95	
MW17-01	30-Dec-94	
MW18-01	30-Dec-94	
MW19-01	30-Dec-94	
MW20-01	30-Dec-94	
LOWER AQUIFER MONITORING WELLS		
MW07-01	3-Jan-95	
MW07-91	3-Jan-95	
MW08-01	30-Dec-94	
MW09-01	4-Jan-95	
MW10-01	4-Jan-95	
MW21-01	4-Jan-95	
MW21-91	4-Jan-95	
MW22-01	30-Dec-94	
MW22-91	30-Dec-94	
MW23-01	5-Jan-95	
MW24-01	4-Jan-95	

Notes:
All results reported in micrograms per liter (ug/L)

Table 4-1

Identification of Detection and Compliance Wells
ACS, Inc. NPL Site

Upper Aquifer Wells	Detection	Compliance	Upgradient	Trans/Down Gradient
MW3		X		X
MW4		X		X
MW11	X		X	
MW12	X		X	
MW13	X	X		X
MW16		X		X
MW17		X	X	
MW18	X	X	X	
MW19	X		X	
MW25		X		X
MW26	X			X
MW27	X		X	
Lower Aquifer Wells				
MW7	X		X	
MW8	X			X
MW9		X		X
MW10	X			X
MW28	X		X	
MW29		X		X
MW30	X			X

J:\4077\0030\WORK_PL\FEB_VER\TABLE4-1.XLS
acc/MJH/DAP
8/14/95

TABLE 4-2
Sample Type and Estimated Sample Numbers
American Chemical Service, Inc. NPL Site
Remedial Investigation

Sample[1] Matrix	Lab[2]	No. of[3] Samples	Field[4] Duplicates	Field[5] Blanks	MS/MSD[6]	Total No. Samples	Lab[7] Parameters	Field Parameters	Lab Methods
UPPER AQUIFER INVESTIGATION									
Groundwater	None	50	–	–	–	50	None	VOC Screening	Vendor
DETECTION/COMPLIANCE MONITORING									
Groundwater	IEA	19	2	2	1	24	Volatiles	pH, Cond, temp	CLP/SOW OLM01.9
		19	2	2	1	24	SVOCs		
		19	2	2	1	24	PCBs		
		19	2	2		23	Metals		
RESIDENTIAL WELL SAMPLING									
Groundwater (Low Level)	IEA	–	–	–	–	–	Volatiles	pH, Cond, temp	CLP/SOW 10/92
WETLANDS SAMPLING									
Surface Water	IEA	5	1	1	1	8	Volatiles	pH,Cond,	CLP/SOW OLM01.9
	IEA	5	1	1	1	8	Semi-Volatiles	temp, DO	"
	IEA	5	1	1	–	7	Fe, Pb, Hg, Zn, Cd, CN		CLP/SOW ILM03.0
	IEA	5	1	1	1	8	PCBs		CLP/SOW OLM01.9
Soil/Sediments	IEA	16	2	–	1	19	VOCs		"
	IEA	16	2	–	1	19	SVOCs		"
	IEA	16	2	–	1	19	PCBs		"
	IEA	16	2	–	–	18	As, Cd, Cr, Cu, Hg, Pb, Zn		CLP/SOW ILM03.0

General Notes:

1. Unless otherwise noted, samples will be considered low concentration, and will be packaged and shipped accordingly.

2. Lab Address and Telephone Number
   IEA Laboratories
   3000 Weston Parkway
   Cary, North Carolina 27513
   1-800-444-9919

3. A trip blank for VOC analysis will be included with each cooler shipped for aqueous (groundwater and surface water) samples. Trip blanks are not included in the total number of samples.

4. Field duplicates will be collected at a ratio of 1 field duplicate for each 10 investigative samples collected.

5. Field blanks will be collected at a ratio of 1 field blank for each 10 aqueous investigative samples collected.

6. EXTRA VOLUME REQUIREMENT: Extra volume is required for the MS/MSD quality control requirements for aqueous samples (triple volume for VOCs, double volume for SVOCs and PCBs.). MS/MSD samples will be collected at a ratio of 1 MS/MSD for each 20 investigative samples. Samples collected for metals and indicators require DUP/MS quality control analyses, however, do not require additional volume to meet the specified QC.

7. Refer to Tables 3-1 through 3-4 for the organics, metals, and groundwater VOC screening parameters and their required detection limits.

JAH/jah/CAW/MJH
J:\4077\0030\WORK_PL\VER_2\PRE_DES\TBL4-2FN.WPD
4077.0030

TABLE 4 - 3
WATER LEVEL MONITORING POINT SURVEY

American Chemical Service, Inc.
Griffith, Indiana
July 1995

Location	Coordinates		Ref. Point	Elevation	Well Status
	East	North	TOC	GS	
MW-1	4305	5783	638.16	635.7	Destroyed
MW-2	5033	6839	638.14	634.8	Needs Repair - Well Casing Bent
MW-3	5341	7359	636.56	634.1	Needs Repair - Protective Casing Heaved up
MW-4	6112	7126	641.06	638.2	Good Condition
MW-5	5788	6482	642.20	639.4	Good Condition
MW-6	5298	5520	655.25	653.0	Good Condition
MW-7	6112	6732	641.51	638.7	Good Condition
MW-8	5934	7506	640.49	638.2	Good Condition
MW-9	4893	6991	639.05	635.9	Good Condition
MW-10	5200	7784	635.58	633.0	Good Condition
MW-11	6377	7329	640.52	637.5	Good Condition
MW-12	6019	6352	642.79	639.7	Good Condition
MW-13	5051	7814	634.17	631.9	Good Condition
MW-14	4882	6995	638.59	636.0	Good Condition
MW-15	4720	5002	637.91	635.2	Good Condition
MW-16	5065	6596	638.54	636.3	Good Condition
MW-17	5656	5677	647.10	648.3	Good Condition
MW-18	5836	5746	644.88	645.4	Good Condition
MW-19	5241	4930	635.77	634.0	Good Condition
MW-20	5081	5017	643.01	641.0	Good Condition
MW-21	4543	7083	633.78	631.3	Good Condition
MW-22	5208	4898	636.49	634.3	Good Condition
MW-23	4711	7418	633.31	631.1	Good Condition
MW-24	4596	8033	635.31	633.1	Good Condition
LW-1	4807	5070	644.61	642.4	Good Condition
LW-2	4662	5465	649.89	647.4	Good Condition
LW-3	4483	5821	645.63	643.3	Abandoned December 1994
LW-4	4229	6132	643.30	641.5	Abandoned December 1994
SG-1	5009	6167	632.77	633.28	Not Functional
SG-2	4464	6852	626.42	627.76	Not Functional
SG-3	4180	7123	629.55	632.08	Not Functional
SG-4	5228	6611	633.43	635.22	Not Functional
SG-5	5466	7713	632.47	632.47	Not Functional
SG-6	4494	8076	630.73	632.49	Not Functional
SG-7	5406	6891	636.67	637.59	Not Functional
SG-8	5483	5202	636.07	636.07	Not Functional
SG-9	3846	6336	632.59	632.59	Not Functional
SG-10	6698	7263	635.39	635.39	Not Functional
P-1	5700	6365	642.85	641.2	Good Condition
P-2	5577	6165	645.59	642.5	Good Condition

TABLE 4 - 3
WATER LEVEL MONITORING POINT SURVEY

Location	Coordinates		Ref. Point	Elevation	Well Status
	East	North	TOC	GS	
P-3	5453	6469	639.89	638.0	Good Condition
P-4	5432	6228	639.28	636.9	Good Condition
P-5	5285	6510	636.62	635.6	Good Condition
P-6	5148	6551	638.77	636.7	Good Condition
P-7	5950	6640	643.64	641.2	Good Condition
P-8	6157	6735	639.21	636.8	Good Condition
P-9	6134	6994	638.90	637.8	Good Condition
P-10	5413	5852	649.37	646.9	Good Condition
P-11	5199	5900	649.17	647.0	Good Condition
P-12	5076	5723	650.11	646.7	Good Condition
P-13	4878	5735	651.48	649.4	Good Condition
P-14	4955	5965	649.35	647.4	Not Functional
P-15	4884	6198	639.06	637.4	Not Functional
P-16	4673	5748	647.84	646.2	Not Functional
P-17	4628	6009	650.62	648.5	Not Functional
P-18	4632	6223	647.97	644.3	Not Functional
P-19	4977	5043	639.64	637.5	Good Condition
P-20	5104	6233	643.15	640.1	Good Condition
P-21	4834	6475	634.81	632.3	Unable to Locate
P-22	4636	6732	634.33	632.2	Good Condition
P-23	4689	7018	636.17	632.5	Good Condition
P-24	5002	7178	636.08	633.3	Good Condition
P-25	5156	7489	635.33	632.1	Unable to Locate
P-26	4727	7361	634.23	631.2	Good Condition
P-27	4904	7020	639.68	636.0	Good Condition
P-28	5883	7486	644.53	640.8	Good Condition
P-29	5738	6619	642.34	638.5	Good Condition
P-30	5607	6816	642.49	639.6	Not Functional
P-31	5480	7159	641.05	638.2	Good Condition
P-32	5742	7008	641.79	639.3	Not Functional
P-33	5219	7130	640.08	637.2	Not Functional
P-34	5280	6692	639.38	637.1	Good Condition
P-35	5507	6584	641.72	637.9	Not Functional
P-36	5412	6842	644.82	641.9	Not Functional
P-37	5330	6949	641.37	639.3	Good Condition
P-38	5149	6992	639.87	637.8	Recently Repaired (3/95) - Needs Repair
P-39	5940	6902	641.49	638.8	Not Functional
P-40	5880	7229	639.31	636.5	Good Condition
P-41	5702	7353	638.53	635.6	Good Condition
P-50	5132	6962	639.49	637.7	Good Condition
P-51	5124	6949	638.87	637.5	Good Condition
M-1S*	4516	5572	NA	NA	Good Condition
M-1D*	4516	5572	NA	NA	Good Condition
M-2S*	4746	6252	NA	NA	Good Condition
M-2D*	4746	6252	NA	NA	Good Condition
M-3S*	4466	6792	NA	NA	Good Condition

TABLE 4 - 3
WATER LEVEL MONITORING POINT SURVEY

Location	Coordinates		Ref. Point	Elevation	Well Status
	East	North	TOC	GS	
M-3D*	4466	6792	NA	NA	Good Condition
M-4S*	5076	6522	NA	NA	Good Condition
M-4D*	5076	6522	NA	NA	Good Condition
M-5S*	4596	7042	NA	NA	Good Condition
M-5D*	4596	7042	NA	NA	Good Condition

Notes

NA - Information available at this time

* - Indicates coordinates for Griffith landfill wells are estimated

TOC - Top of inner casing elevation - mean sea level (msl)

GS - Ground surface elevation - mean sea level (msl)

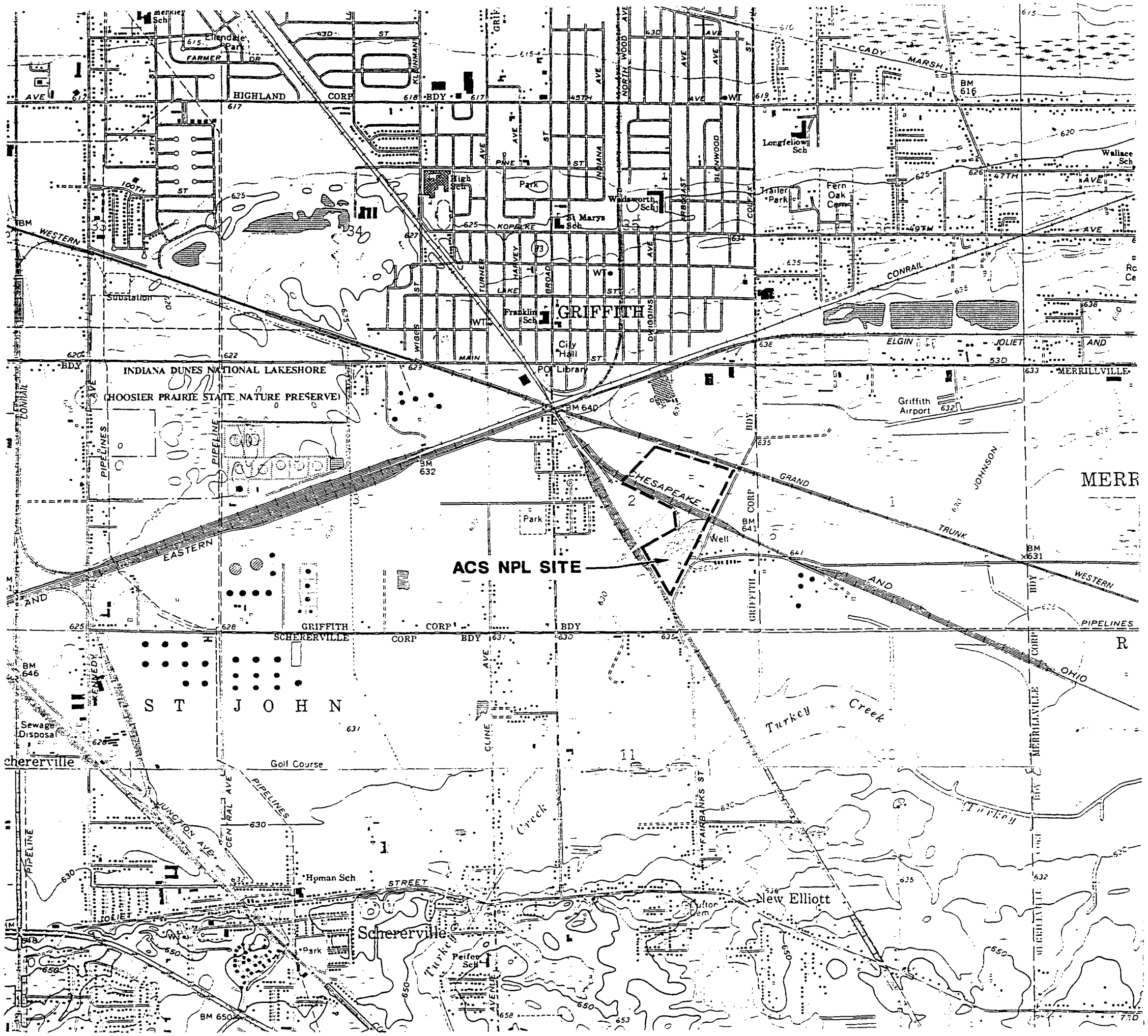
Not funtional means not useable for water level measurements

TABLE 5-1

ANALYTICAL SAMPLING METHODS
ISVE/BIOVENTING PILOT STUDY

	Parameter	Method
I.	Soil	
	VOCs	SW846 Method 8240
	SVOCs	SW846 Method 8270
	Grain Size Analysis	ASTM D422-90
	Percent Moisture	ASTM D2216-90
	Total Organic Carbon Content	ASTM D2974-87
	Permeability	U.S. Army Corps
	Porosity	Estimated
	Nitrogen, Ammonia	E3550.3
	Nitrogen, Total Kjeldahl	E351.3
	Total Phosphorous	E365.2
	Total Potassium	SW846 Method 7610
	Bacterial Plate Count	Conventional Plate Count or Equivalent
II.	Air	
	VOCs	EPA Method TO14

FIGURES



NOTES

1. BASE MAP DEVELOPED FROM HIGHLAND AND ST. JOHN, INDIANA 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAPS DATED 1968 AND 1962 RESPECTIVELY, PHOTOREVISED 1980.

north

0 2000 4000

SCALE IN FEET FIGURE 2-1

Developed By PMS, DAP Drawn By DLL, TMS, LCL

Approved By M. Hyman Date 2-6-95

Reference MANUAL DRAWING 60251-B18

Revisions

SITE LOCATION MAP

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 B

MONTGOMERY WATSON

Management Review
Other

Technical Review
Project Manager

Graphic Standards
Lead Professional

QUALITY CONTROL

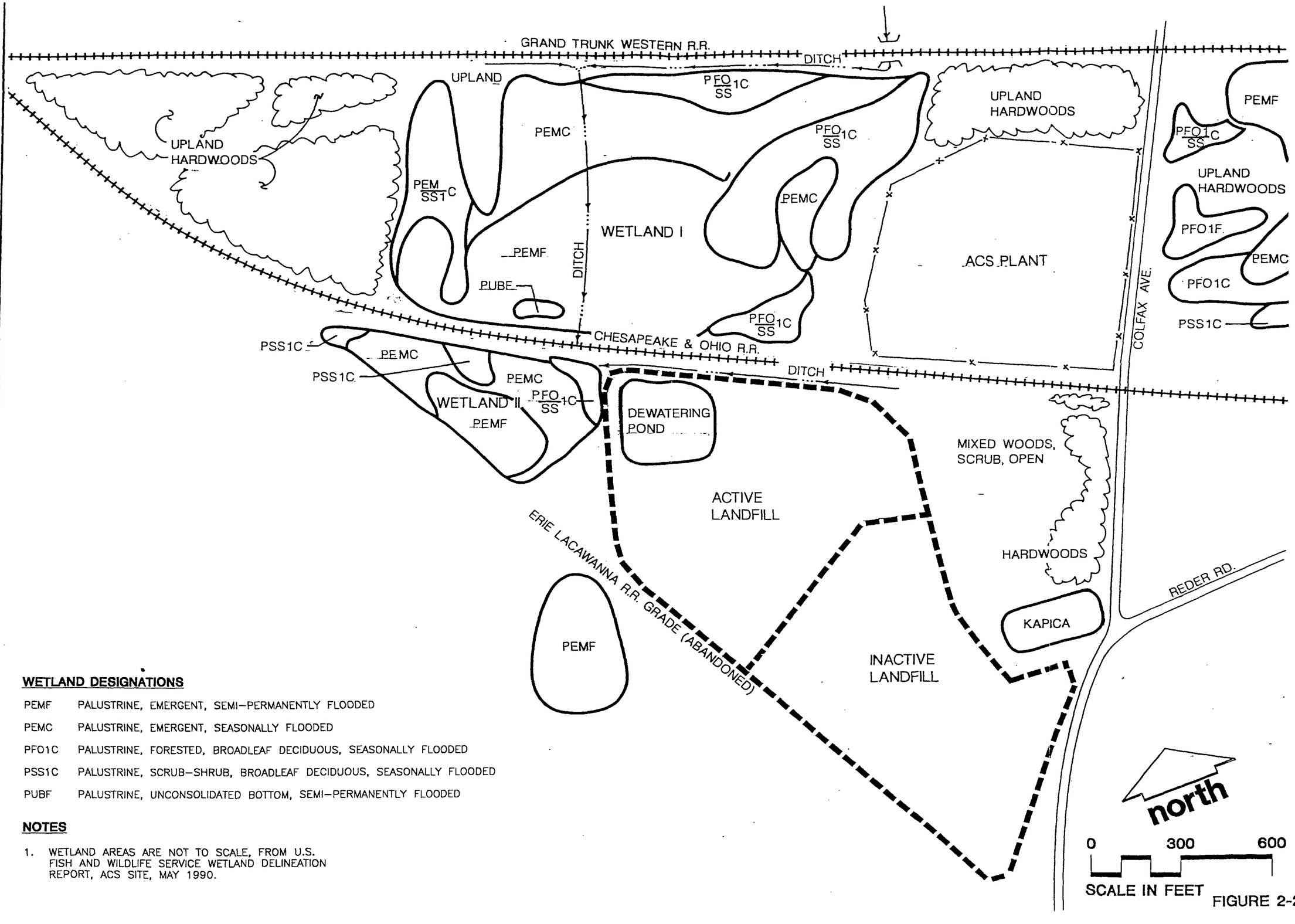


FIGURE 2-2

WETLAND DESIGNATIONS

PEMF	PALUSTRINE, EMERGENT, SEMI–PERMANENTLY FLOODED
PEMC	PALUSTRINE, EMERGENT, SEASONALLY FLOODED
PFO1C	PALUSTRINE, FORESTED, BROADLEAF DECIDUOUS, SEASONALLY FLOODED
PSS1C	PALUSTRINE, SCRUB–SHRUB, BROADLEAF DECIDUOUS, SEASONALLY FLOODED
PUBF	PALUSTRINE, UNCONSOLIDATED BOTTOM, SEMI–PERMANENTLY FLOODED

NOTES

1. WETLAND AREAS ARE NOT TO SCALE, FROM U.S. FISH AND WILDLIFE SERVICE WETLAND DELINEATION REPORT, ACS SITE, MAY 1990.

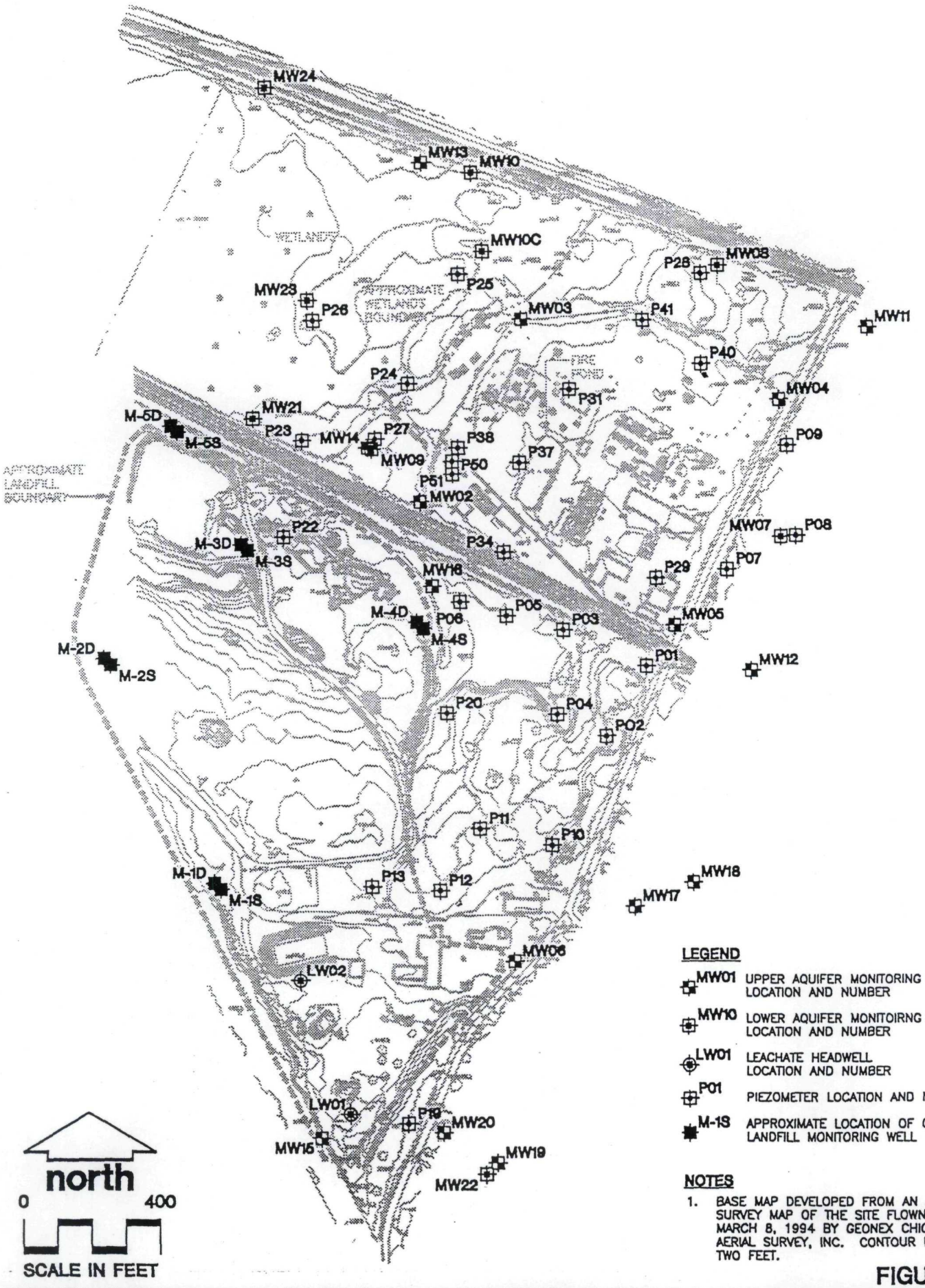
Management Review
Other
Technical Review
Project Manager
Graphic Standards
Lead Professional
QUALITY CONTROL

Developed By
Drawn By TPB
Approved By M. Heath
Date 2-8-95
Reference
Revisions

WETLANDS LOCATION MAP
PRE–DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
4077.0030 B2

MONTGOMERY WATSON



LEGEND

- MW01 UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW10 LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- LW01 LEACHATE HEADWELL LOCATION AND NUMBER
- P01 PIEZOMETER LOCATION AND NUMBER
- M-1S APPROXIMATE LOCATION OF GRIFFITH LANDFILL MONITORING WELL

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC. CONTOUR INTERVAL TWO FEET.

FIGURE 2-3

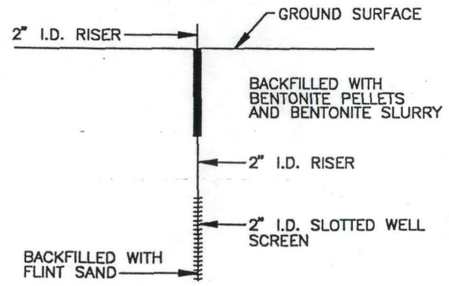
Developed By PMS,DAP,MJH	Drawn By TMS,LCL,TPB	WATER LEVEL MONITORING POINTS	Drawing Number 4077.0030 A1
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	MONTGOMERY WATSON
Reference			
Revisions			

LEGEND

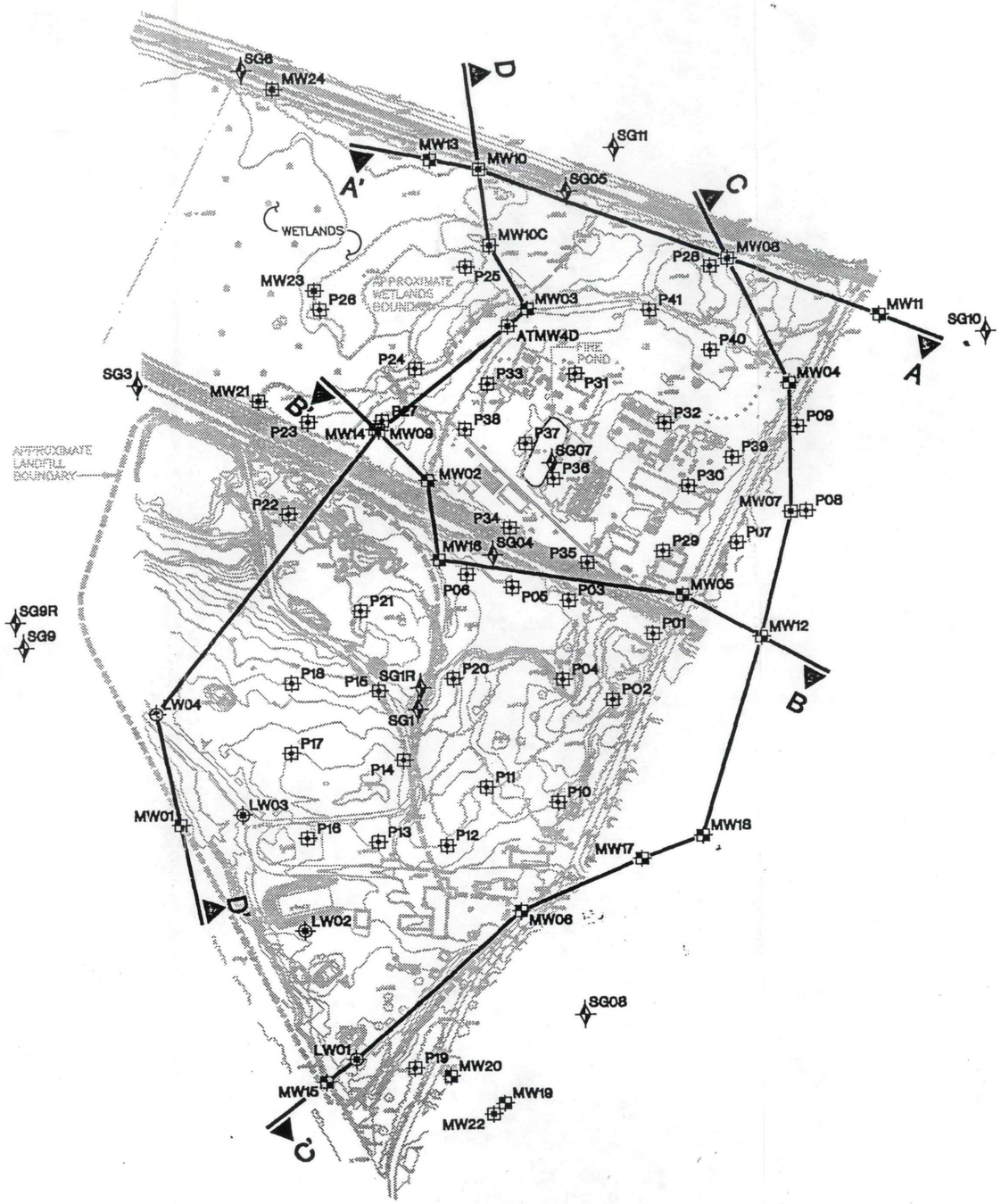
LEAN CLAY	GRAVELLY SILT	UPPER AQUIFER WATER LEVEL	
SILTY CLAY	SILTY SAND	LOWER AQUIFER WATER LEVEL	
SANDY LEAN CLAY	PEAT OR ORGANIC SILT OR CLAY		
FILL	CLEAN SAND		
CLEAN GRAVEL	CLAYEY SAND		
CLAYEY GRAVEL	CLAYEY SAND		
SILTY GRAVEL	GRAVELLY SAND		
SANDY GRAVEL	SANDY SILT		
SILT	TOPSOIL		

NOTES

1. THE STRATUM LINES ARE BASED ON INTERPOLATION BETWEEN BORINGS AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.
2. FOR THE PURPOSE OF ILLUSTRATING SUBSOIL CONDITIONS ON THE CROSS SECTIONS, SOME OF THE BORING LOGS HAVE BEEN SIMPLIFIED. FOR A DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT INDIVIDUAL BORINGS, REFER TO SOIL BORING LOGS, APPENDIX D OF THE REMEDIAL INVESTIGATION REPORT.
3. FOR COMPLETE MONITORING WELL INSTALLATION DETAILS REFER TO APPENDIX E OF THE REMEDIAL INVESTIGATION REPORT.
4. CROSS SECTIONS HAVE BEEN VERTICALLY EXAGGERATED TWENTY TIMES.
5. HORIZONTAL DISTANCES ARE MEASURED WITH RESPECT TO THE CENTER OF EACH SOIL BORING LOCATION.
6. EXISTING GROUND SURFACE WAS TAKEN FROM FIGURE FURNISHED BY GEONEX AERIAL SURVEY, DATED MARCH 8, 1994.
7. ELEVATIONS ARE SHOWN IN REFERENCE TO U.S.G.S. DATUM.
8. QUESTION MARKS AT THE CONTACTS BETWEEN SUBSOIL TYPES INDICATES THE CONTACTS ARE INFERRED.
9. MONITORING WELL ATMW-4D WAS INSTALLED BY ATEC ASSOCIATES ON SEPTEMBER 27, 1985.
10. THE GROUNDWATER ELEVATIONS SHOWN ARE BASED ON WATER LEVELS OBTAINED BY WARZYN ENGINEERING, INC. ON JULY 18, 1990. WHERE NOT MEASURED DIRECTLY, WATER LEVELS HAVE BEEN EXTRAPOLATED FROM THE WATER TABLE AND POTENTIOMETRIC SURFACE MAPS CONSTRUCTED FOR THAT DATE.



TYPICAL WELL INSTALLATION DETAIL



CROSS SECTION LOCATION MAP

0 400 800

SCALE IN FEET

north

FIGURE 2-4

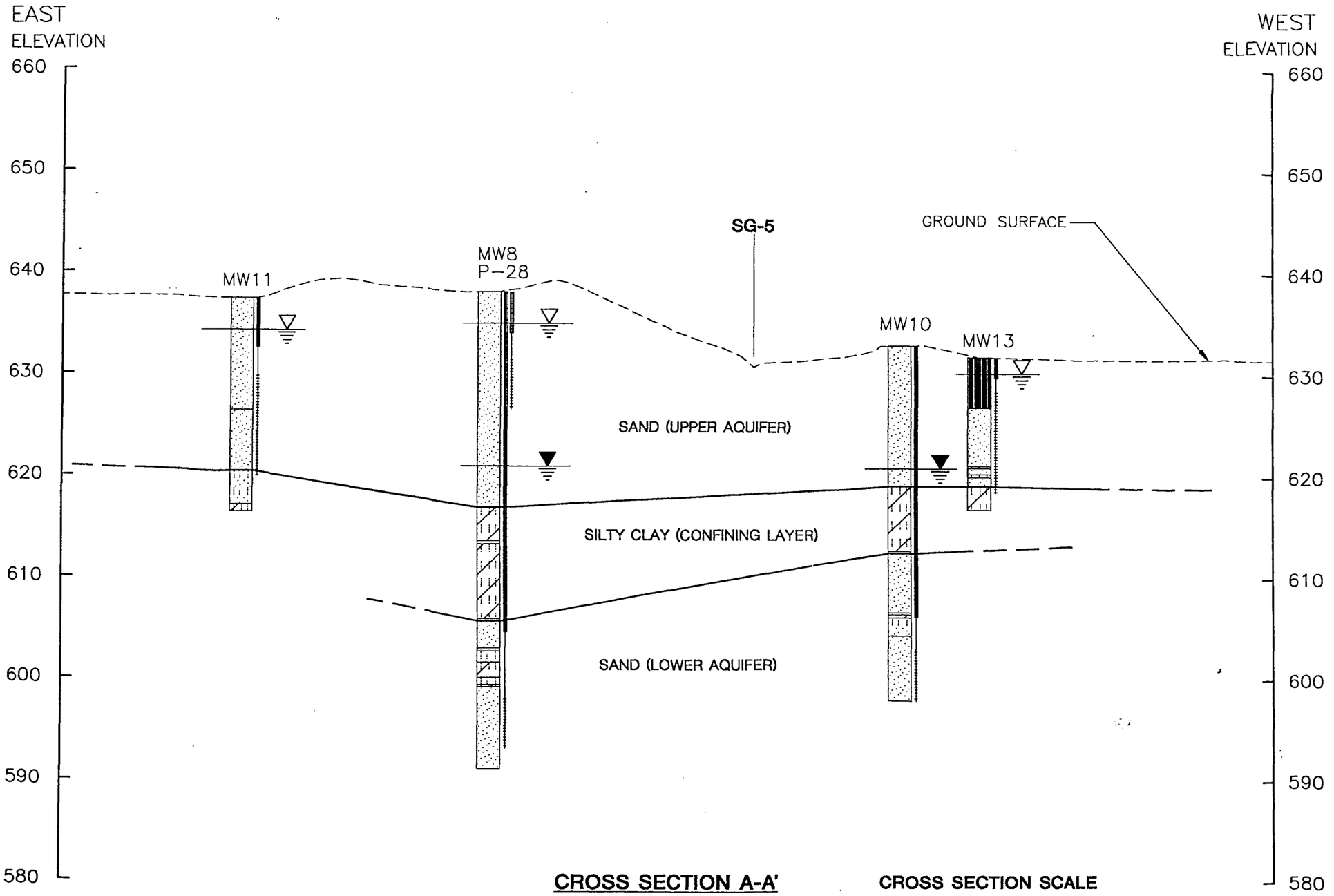
Developed By
Drawn By TPB
Approved By
Date
Reference
Revisions

CROSS SECTION LOCATION MAP, NOTES AND LEGEND

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
4077.0030 **B3**

MONTGOMERY WATSON



CROSS SECTION A-A'

CROSS SECTION SCALE

SCALE IN FEET

VERTICAL EXAGGERATION: TWENTY TIMES

FIGURE 2-5

Developed By

Drawn By TPB

Approved By [signature] Date 2-8-95

Reference

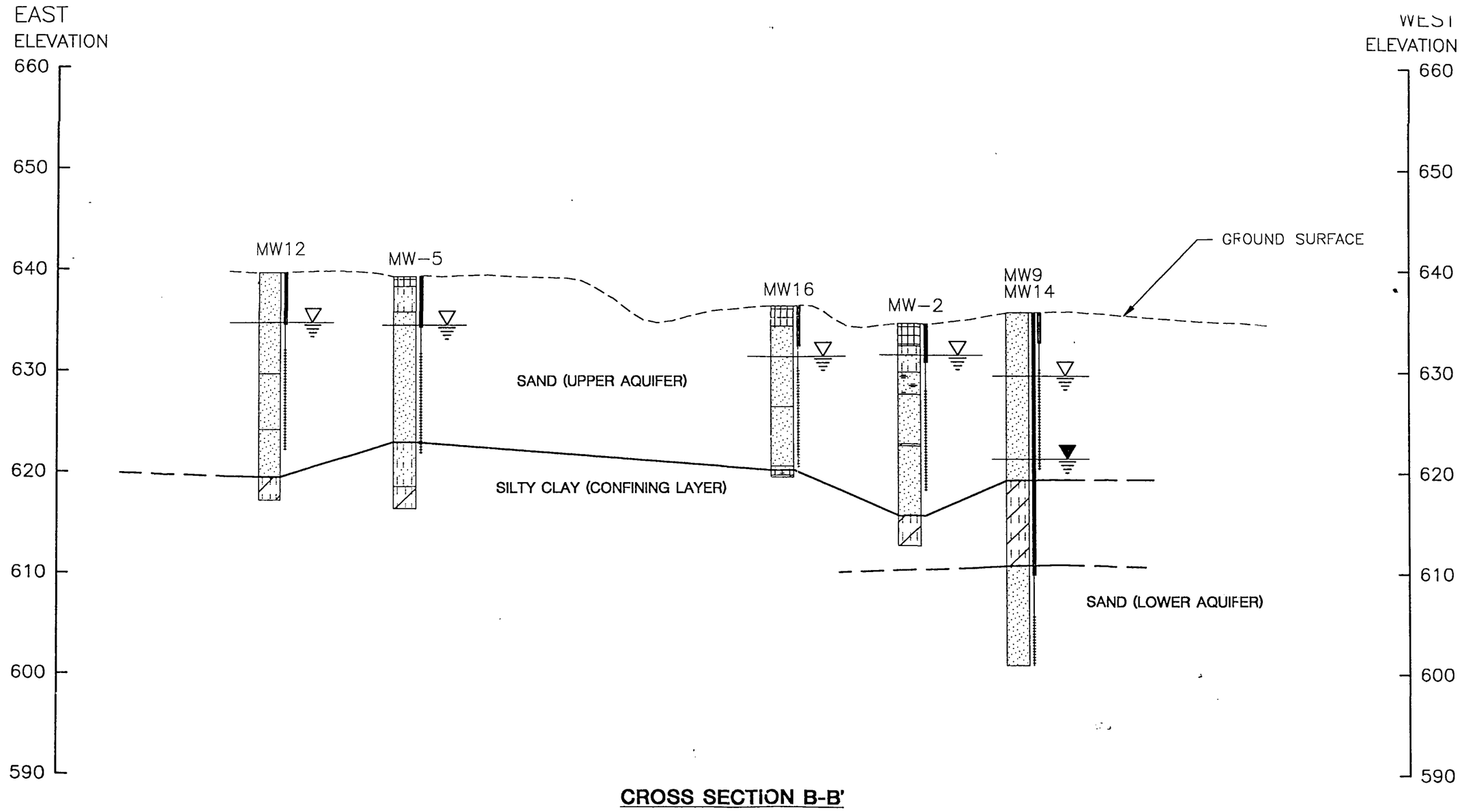
Revisions

GEOLOGIC CROSS SECTION A-A'

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
MPL SITE
GRIFFITH, INDIANA

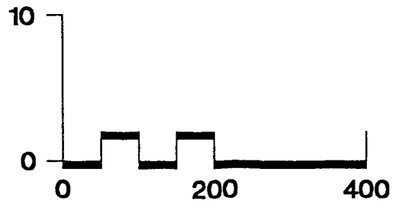
Drawing Number
4077.0030 B4

MONTGOMERY WATSON



CROSS SECTION B-B'

CROSS SECTION SCALE



SCALE IN FEET
VERTICAL EXAGGERATION: TWENTY TIMES

FIGURE 2-6

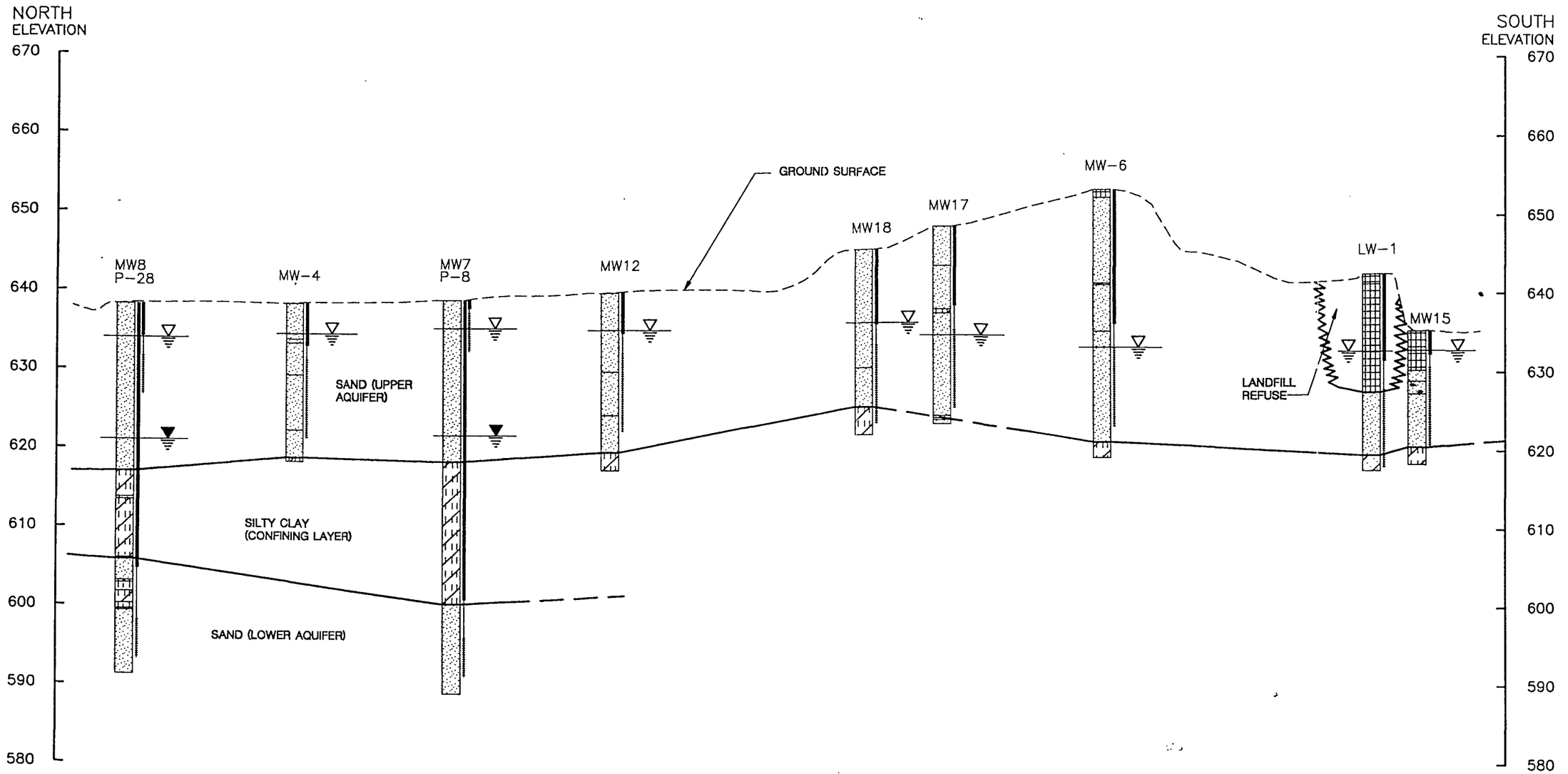
Developed By
Drawn By TPB
Approved By
Date 2-6-98
Reference
Revisions

GEOLOGIC CROSS SECTION B-B'

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
4077.0030 B5

MONTGOMERY WATSON



CROSS SECTION C-C'

CROSS SECTION SCALE

10

0

0 200 400

SCALE IN FEET

VERTICAL EXAGGERATION: TWENTY TIMES

FIGURE 2-7

Developed By

Drawn By TPB

Approved By

Date 8-6-93

Reference

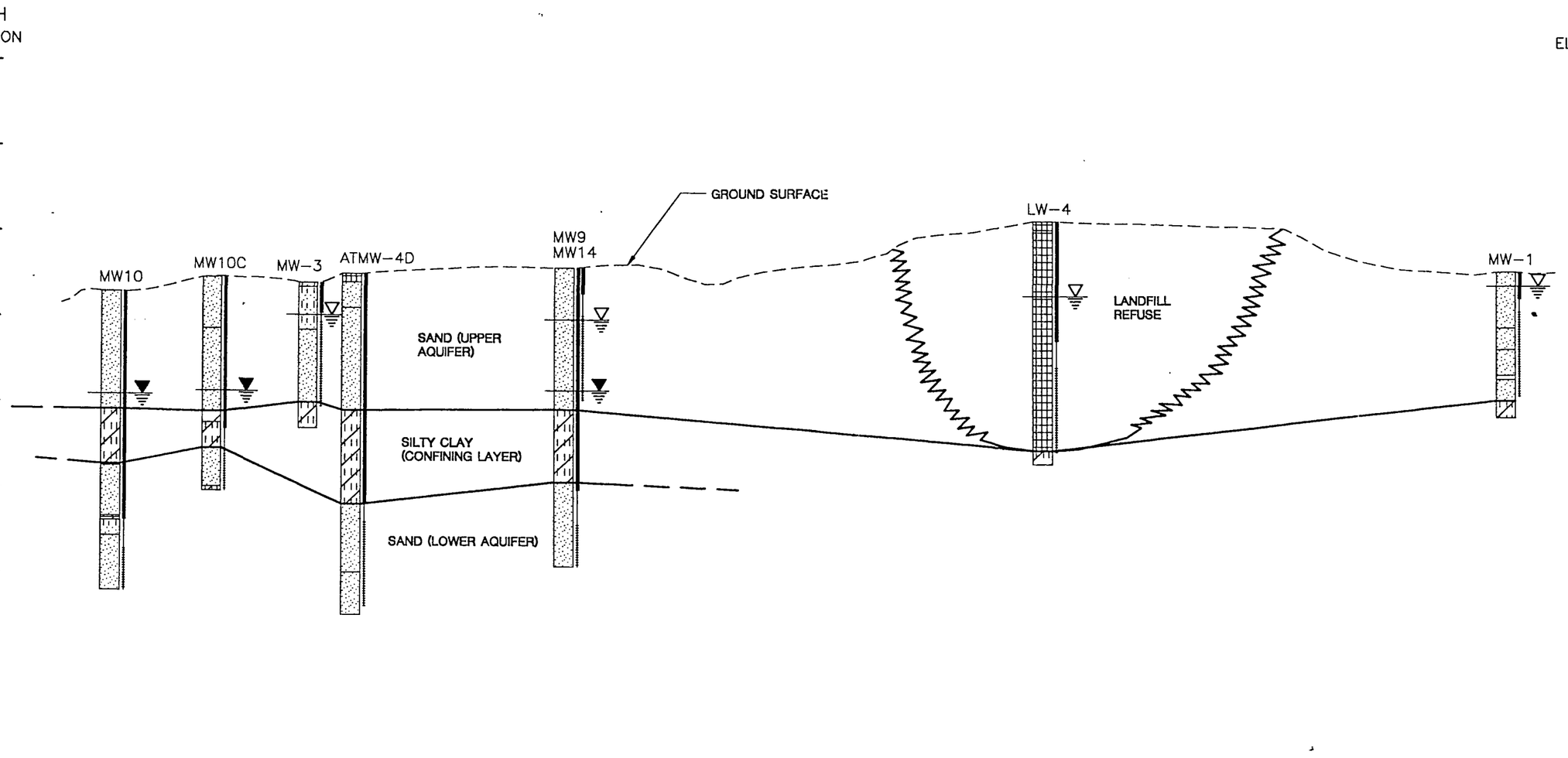
Revisions

GEOLOGIC CROSS SECTION C-C'

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

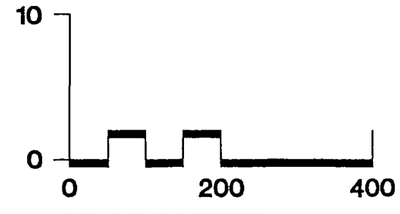
Drawing Number
4077.0030 B6

MONTGOMERY WATSON



CROSS SECTION D-D'

CROSS SECTION SCALE



SCALE IN FEET
VERTICAL EXAGGERATION: TWENTY TIMES

FIGURE 2-8

Developed By
Drawn By TPB
Approved By
Date 2-6-97
Reference
Revisions

GEOLOGIC CROSS SECTION D-D'

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
4077.0030 B7

MONTGOMERY WATSON

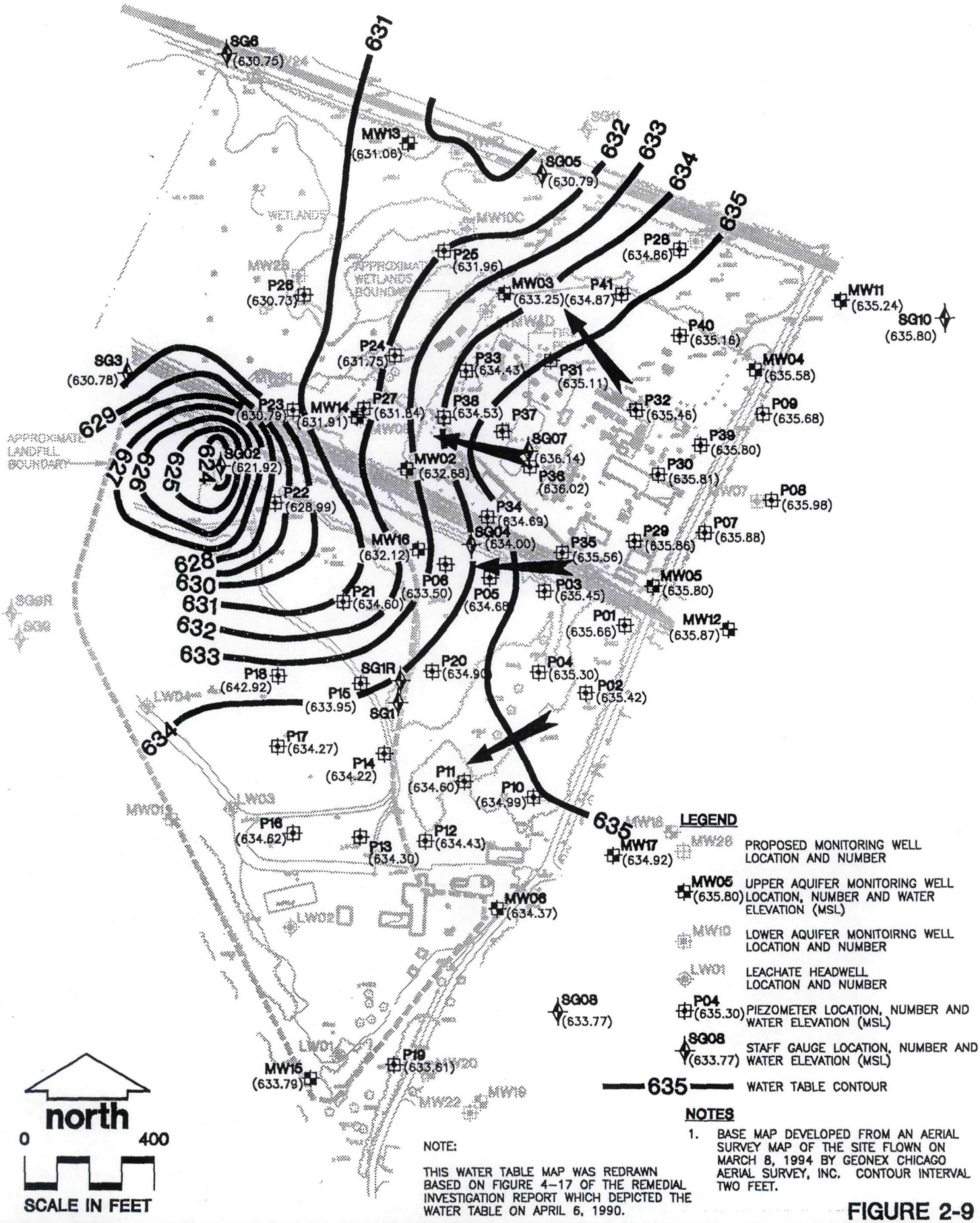
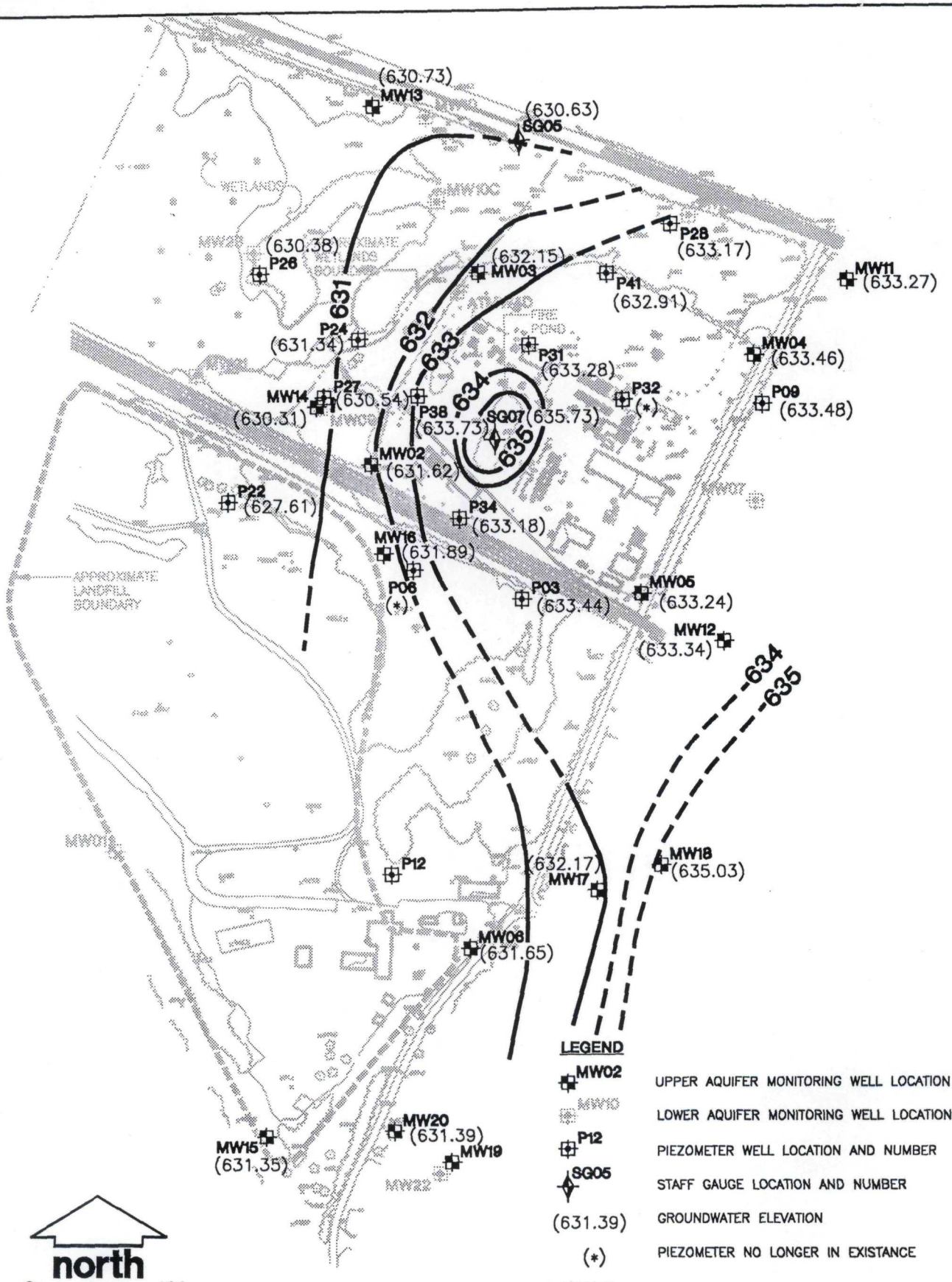


FIGURE 2-9

Management Review
Other
Technical Review
Project Manager
Graphic Standards
Lead Professional
QUALITY CONTROL

Developed By PMS,DAP,MJH	Drawn By TMS,LCL,TPB	UPPER AQUIFER WATER TABLE MAP	Drawing Number 4077.0030 A2
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	MONTGOMERY WATSON
Reference			
Revisions			



NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.

FIGURE 2-10

Developed By DER Drawn By JSL
Approved By [signature] Date 8/17/95
Reference
Revisions

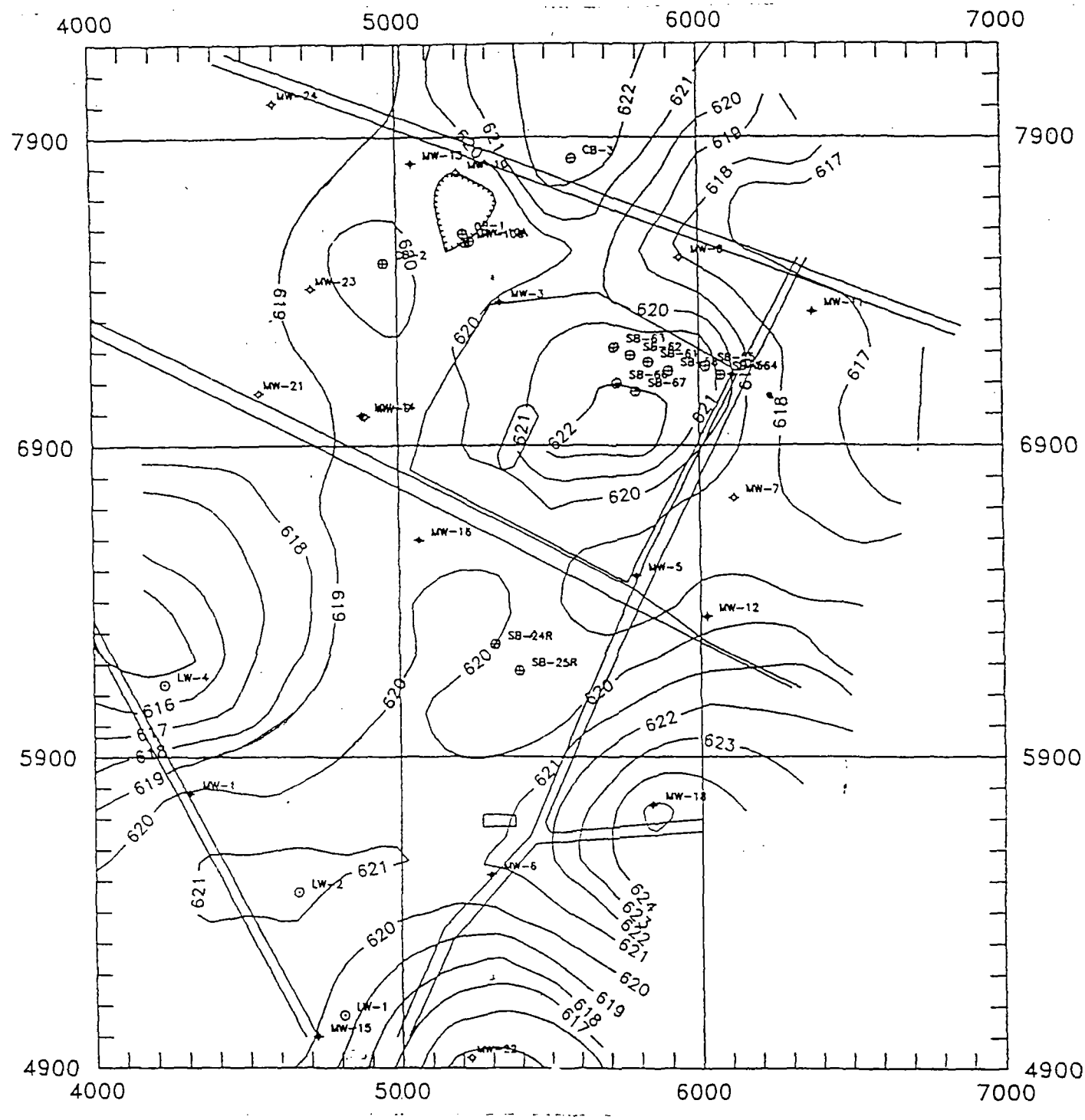
UPPER AQUIFER WATER TABLE MAP (DECEMBER 27 AND 28, 1994)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 **A31**

MONTGOMERY WATSON

Management Review: Other
Technical Review: Project Manager
Graphic Standards: Lead Professional
QUALITY CONTROL



LEGEND

- UPPER AQUIFER MONITORING WELL LOCATION
- LOWER AQUIFER MONITORING WELL LOCATION
- LEACHATE WELL LOCATION
- SOIL BORING LOCATION

north

0 500 1000

SCALE IN FEET

FIGURE 2-11

Developed By DLL, KJM, DAW Drawn By JSL

Approved By [signature] Date 8/17/95

Reference

Revisions

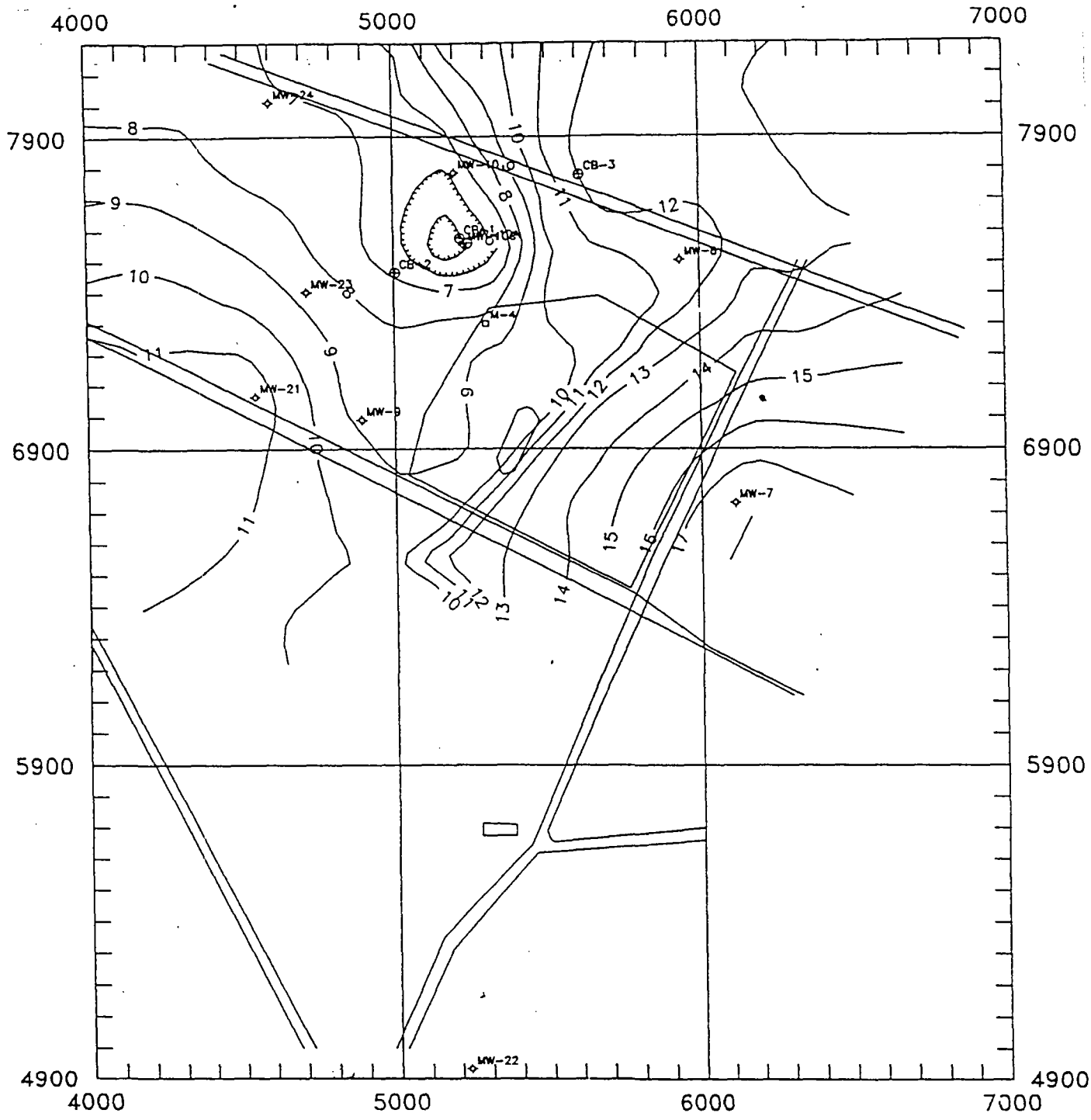
REPRINTED FROM FIGURE 4-7 OF THE ACS RI REPORT.

TOP OF CLAY CONTOUR MAP

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 A45

MONTGOMERY WATSON



LEGEND

- ☼ LOWER AQUIFER MONITORING WELL LOCATION
- ⊕ SOIL BORING LOCATION
- ~ CLAY THICKNESS CONTOUR LINE

north

0 500 1000

SCALE IN FEET

FIGURE 2-12

Developed By DLL, TOM, DAW	Drawn By JSL	THICKNESS OF CLAY CONFINING LAYER	Drawing Number 4077.0030 A44
Approved By [signature]	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	MONTGOMERY WATSON
Reference			
Revisions REPRINTED FROM FIGURE 4-9 OF THE ACS RI REPORT.			

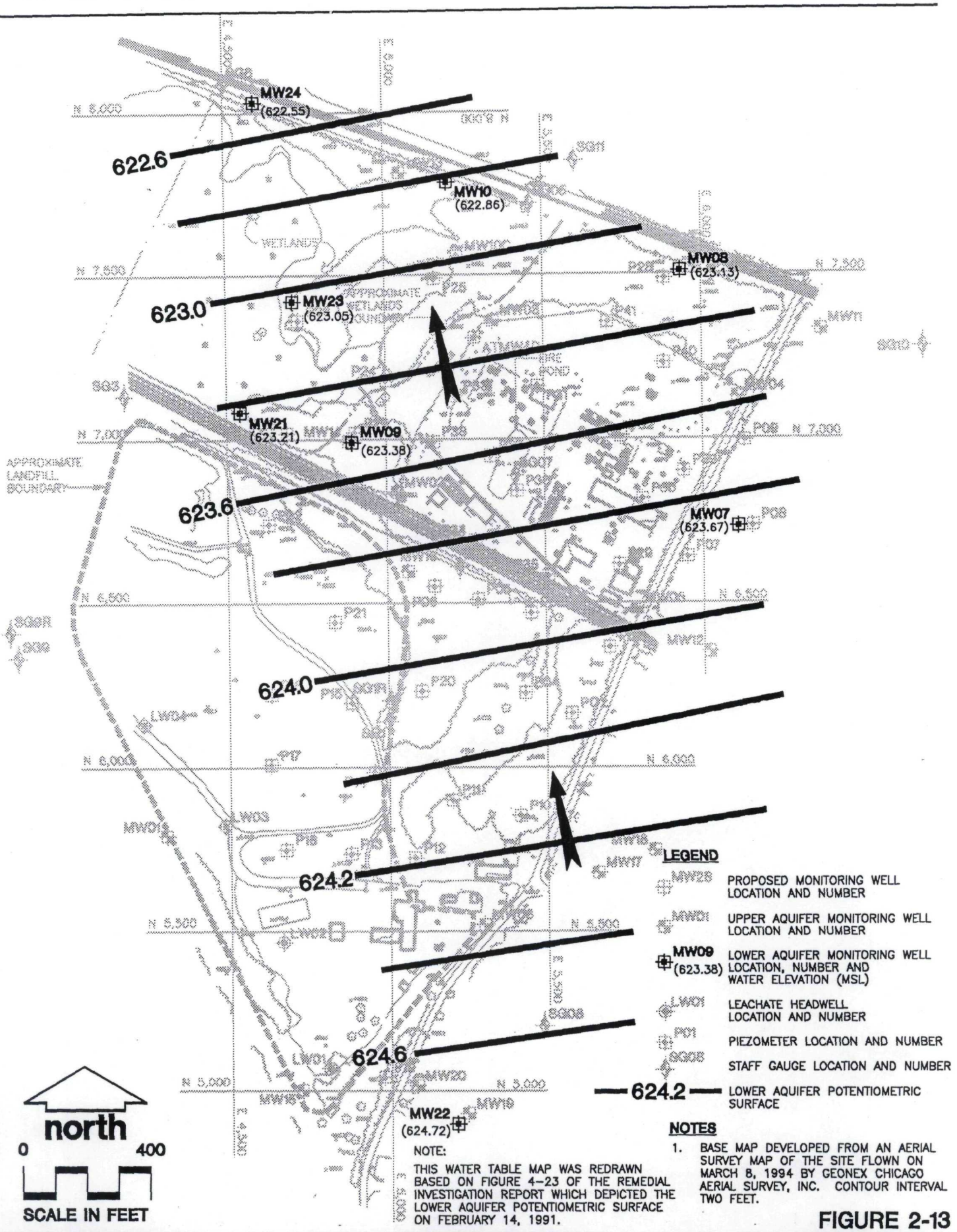
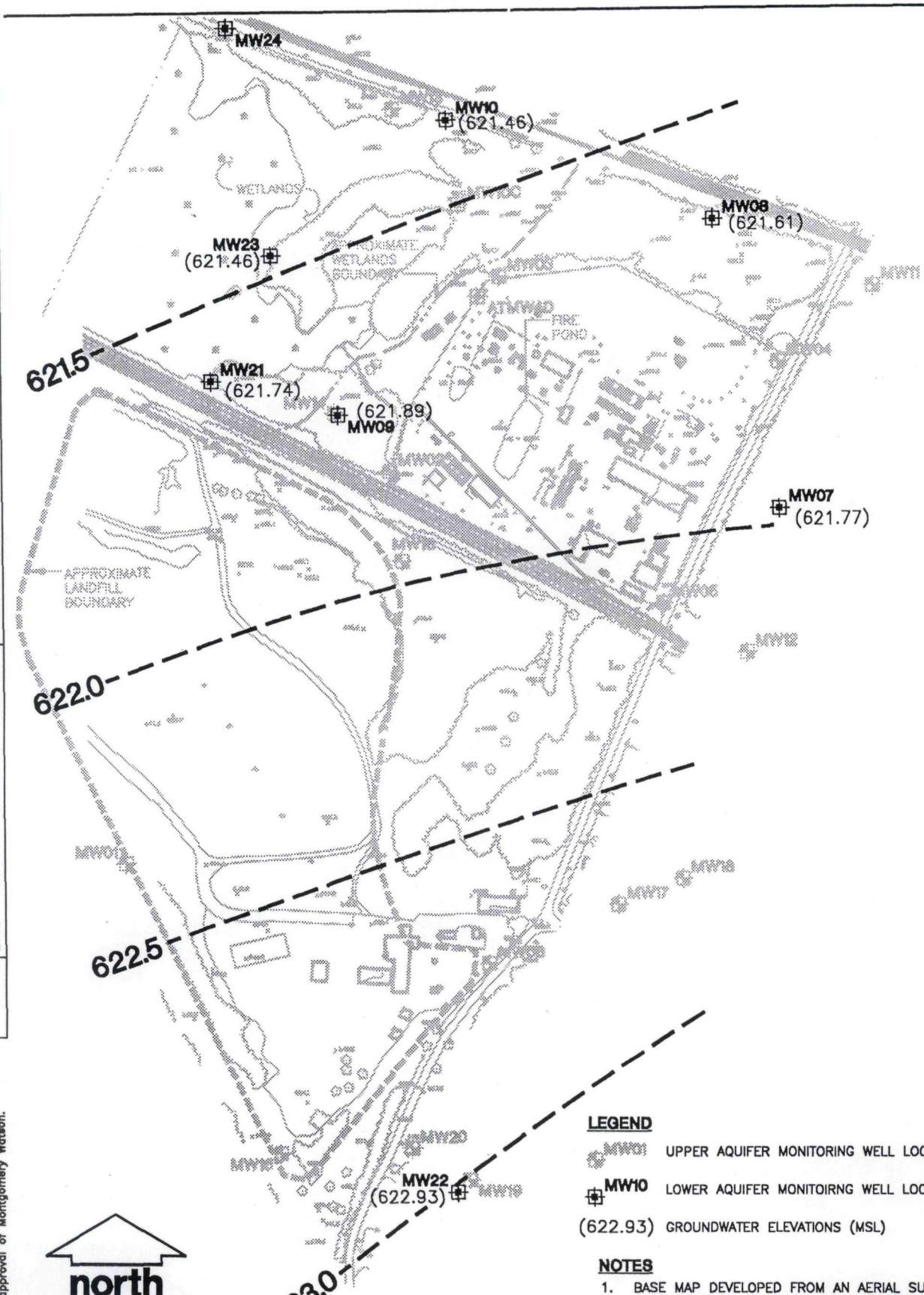


FIGURE 2-13

QUALITY CONTROL | Graphic Standards | Lead Professional | Technical Review | Project Manager | Management Review | Other

Developed By PMS,DAP,MJH	Drawn By TMS,LCL,TPB	**LOWER AQUIFER POTENTIOMETRIC SURFACE MAP**	Drawing Number 4077.0030 A3
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	MONTGOMERY WATSON
Reference			
Revisions			



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW10 — LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- (622.93) — GROUNDWATER ELEVATIONS (MSL)

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.

north

0 400

SCALE IN FEET

FIGURE 2-14

Developed By ACC/DAP Drawn By JSL

Approved By [signature] Date 8/17/95

Reference

Revisions

LOWER AQUIFER POTEMTOMETRIC MAP (DECEMBER 28, 1994)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 A32

MONTGOMERY WATSON

Management Review — Other

Technical Review — Project Manager

QUALITY CONTROL — Graphic Standards — Lead Professional

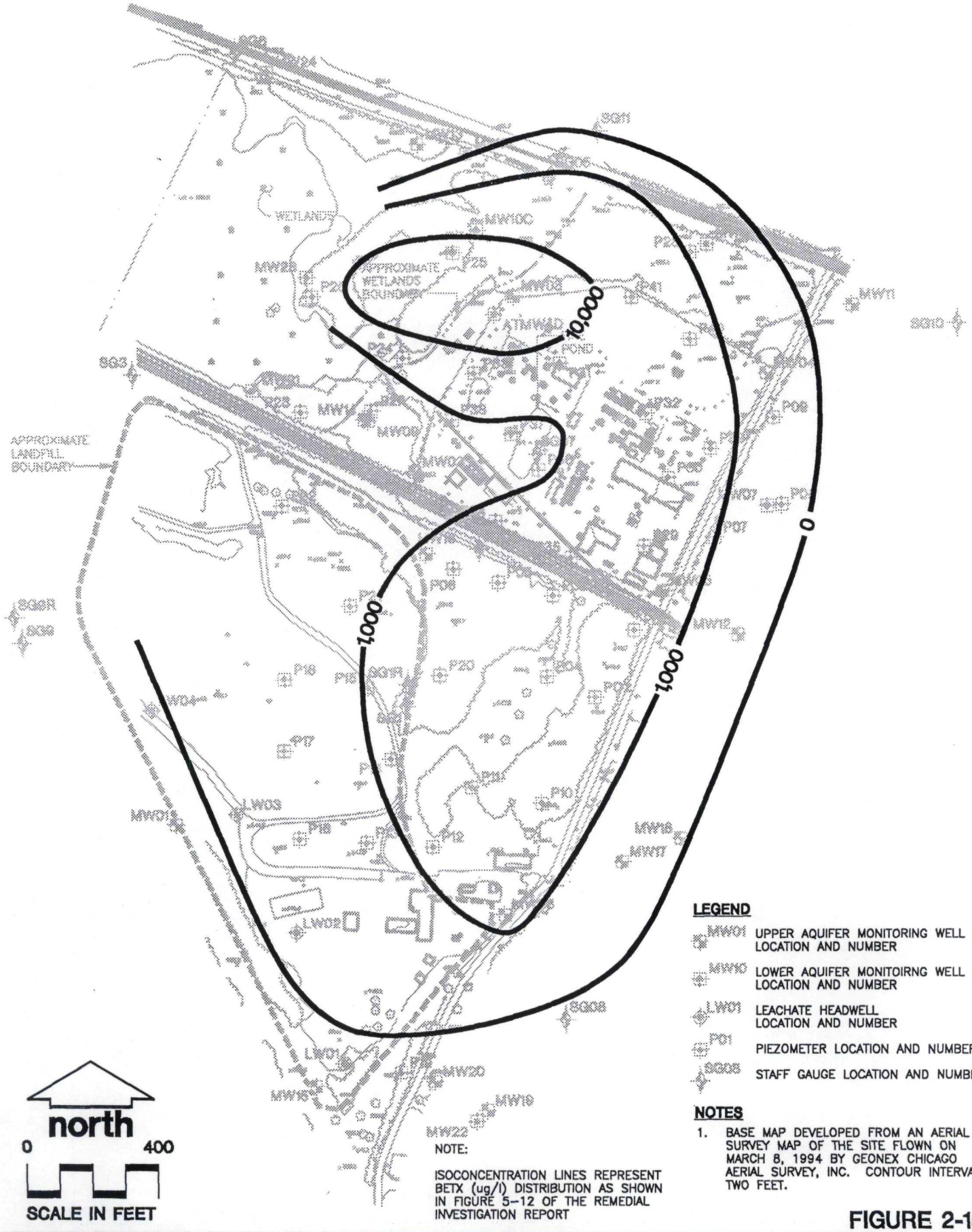


FIGURE 2-15

Developed By PMS,DAP,MJH Drawn By TMS,LCL,TPB

Approved By Date 8/17/95

Reference

Revisions

UPPER AQUIFER BETX PLUME MAP

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 A4

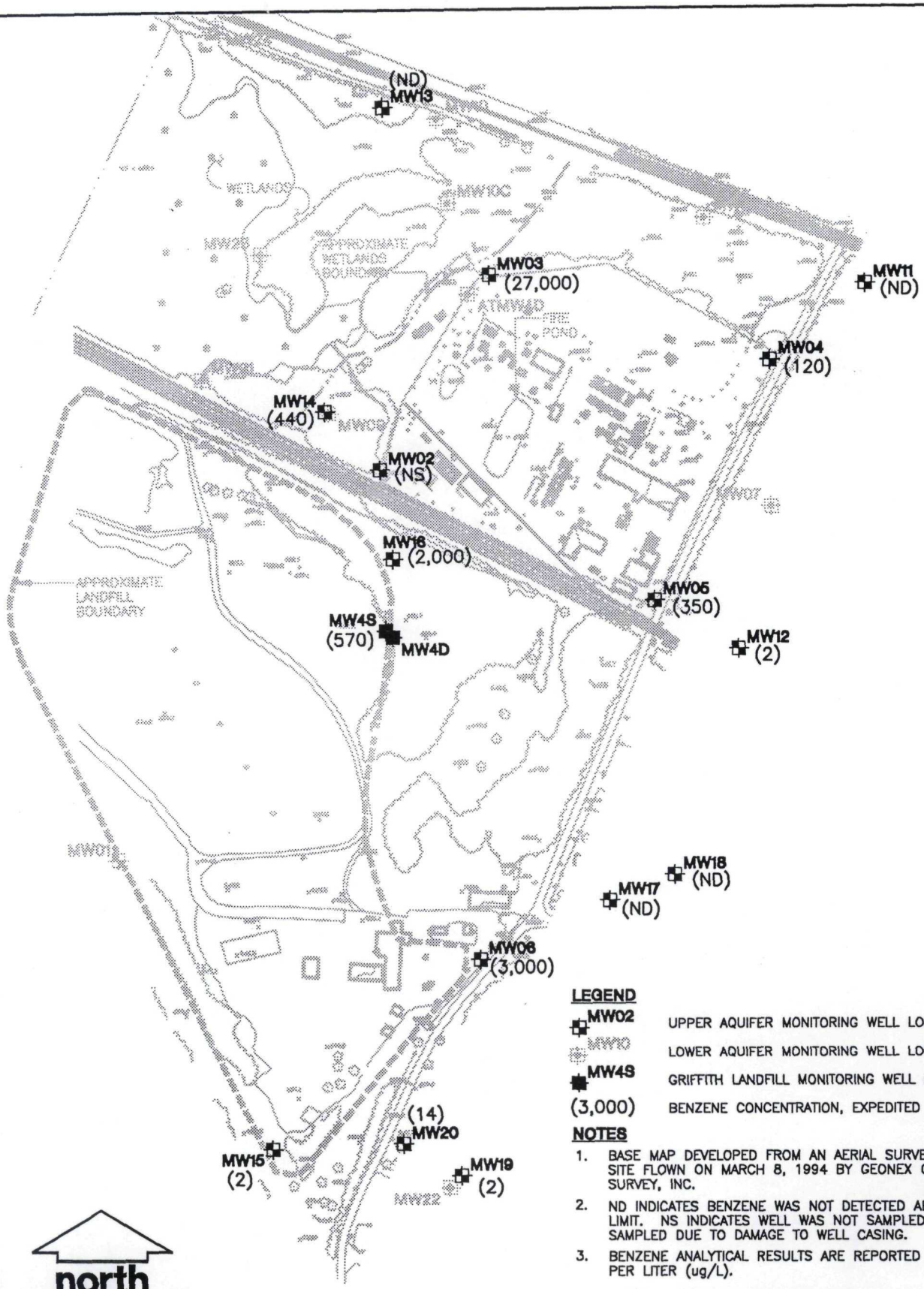
MONTGOMERY WATSON

Management Review
Other

Technical Review
Project Manager

Graphic Standards
Lead Professional

QUALITY CONTROL



LEGEND

MW02	UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
MW10	LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER
MW4S	GRIFFITH LANDFILL MONITORING WELL LOCATION AND NUMBER
(3,000)	BENZENE CONCENTRATION, EXPEDITED SAMPLING (ug/L)

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES BENZENE WAS NOT DETECTED ABOVE THE DETECTION LIMIT. NS INDICATES WELL WAS NOT SAMPLED. MW02 WAS NOT SAMPLED DUE TO DAMAGE TO WELL CASING.
3. BENZENE ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
4. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
5. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

north

0 400

SCALE IN FEET

FIGURE 2-16

Developed By ACC,DAP Drawn By JSL,TPB

Approved By Date 8/17/95

Reference

Revisions

UPPER AQUIFER BENZENE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

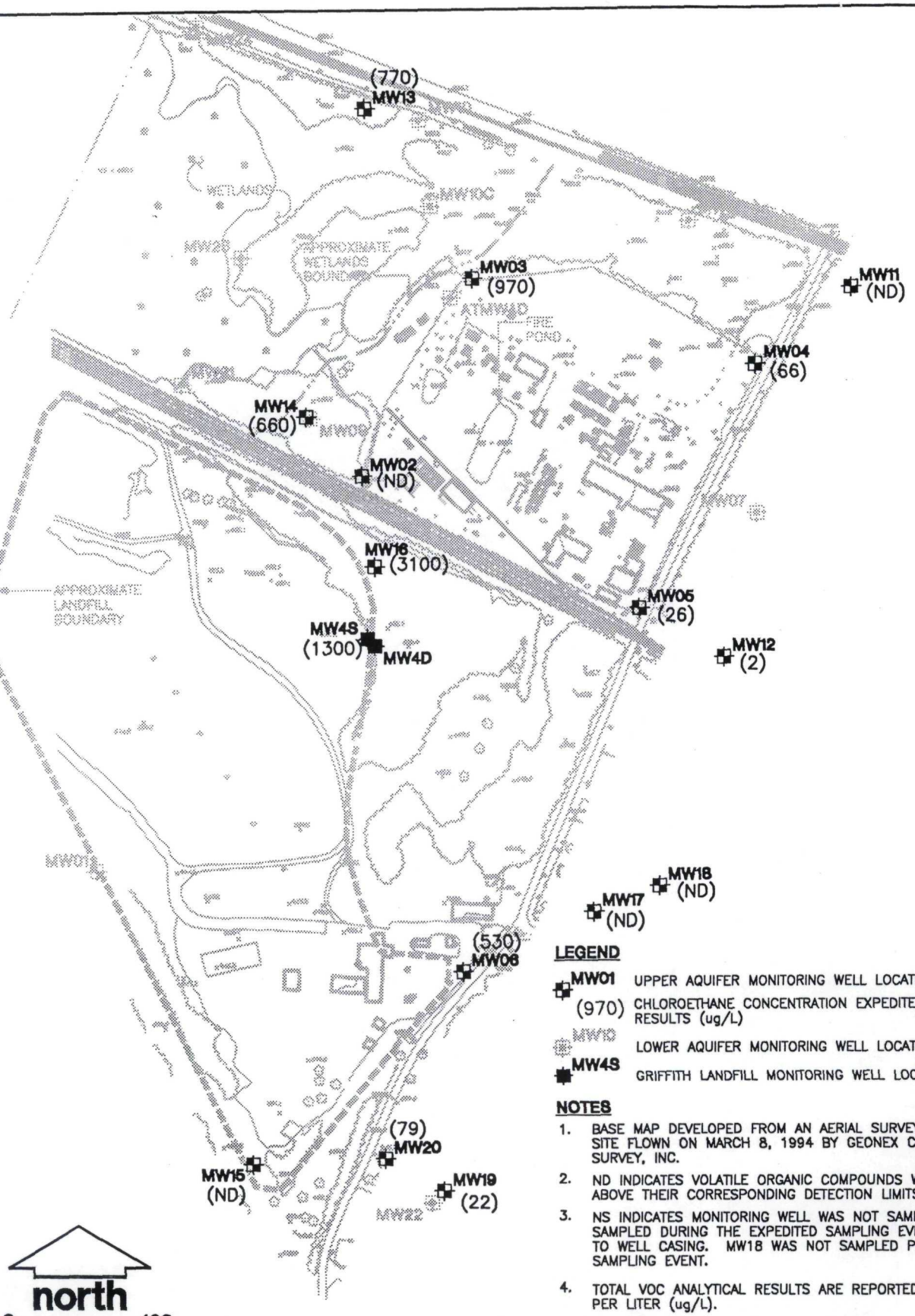
Drawing Number 4077.0030 A34

MONTGOMERY WATSON

Management Review: Other

Technical Review: Project Manager

QUALITY CONTROL: Graphic Standards, Lead Professional



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- (970) — CHLOROETHANE CONCENTRATION EXPEDITED SAMPLING RESULTS (ug/L)
- MW1D — LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW4S — GRIFFITH LANDFILL MONITORING WELL LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES VOLATILE ORGANIC COMPOUNDS WERE NOT DETECTED ABOVE THEIR CORRESPONDING DETECTION LIMITS.
3. NS INDICATES MONITORING WELL WAS NOT SAMPLED. MW2 WAS NOT SAMPLED DURING THE EXPEDITED SAMPLING EVENT DUE TO DAMAGE TO WELL CASING. MW18 WAS NOT SAMPLED PRIOR TO THE EXPEDITED SAMPLING EVENT.
4. TOTAL VOC ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
5. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
6. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

FIGURE 2-17

Developed By DAP Drawn By JSL
Approved By [signature] Date 8/17/95
Reference
Revisions

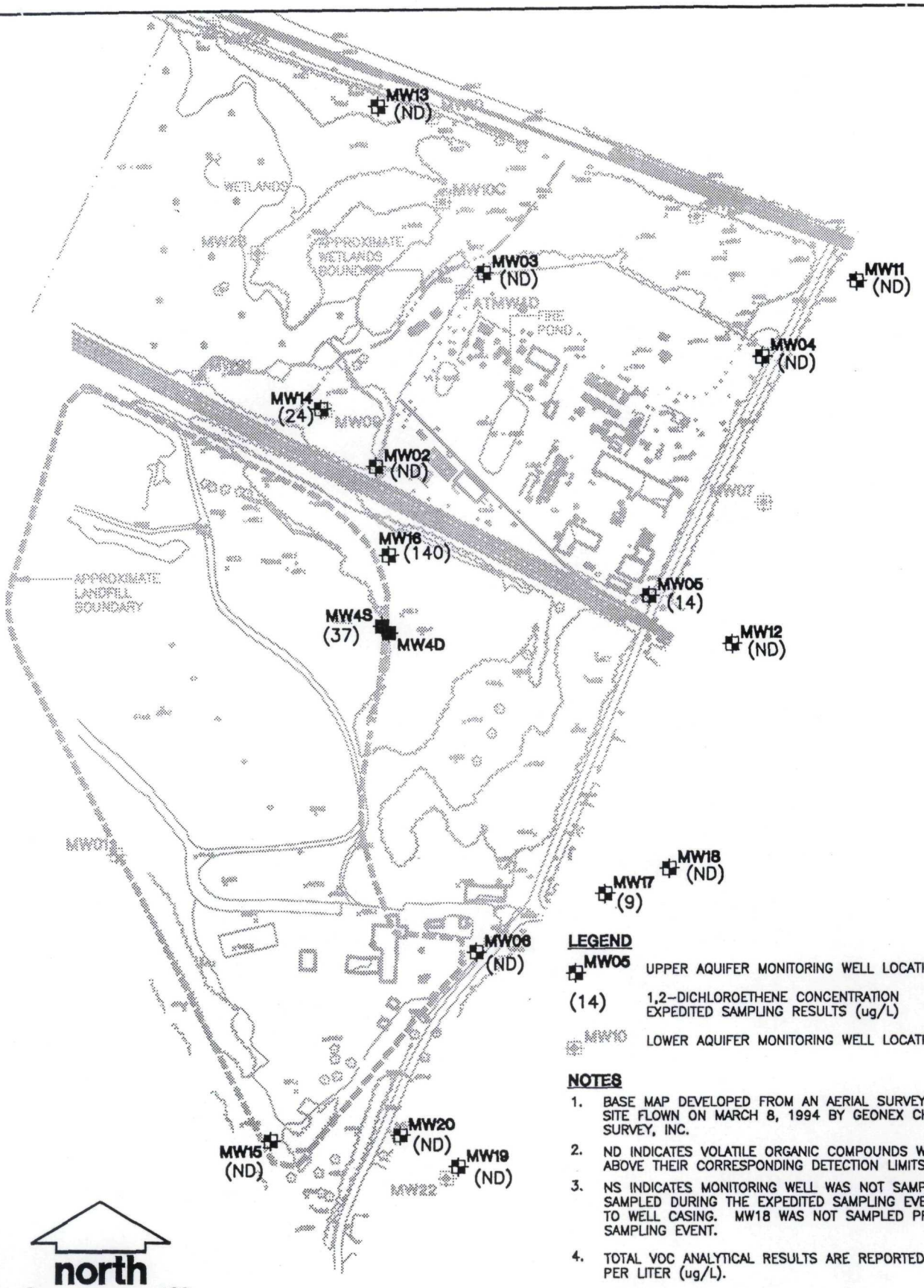
UPPER AQUIFER CHLOROETHANE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 **A36**

MONTGOMERY WATSON

Management Review — Other
Technical Review — Project Manager
QUALITY CONTROL — Graphic Standards — Lead Professional



LEGEND

- MW05 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- (14) — 1,2–DICHLOROETHENE CONCENTRATION EXPEDITED SAMPLING RESULTS (ug/L)
- MW10 — LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES VOLATILE ORGANIC COMPOUNDS WERE NOT DETECTED ABOVE THEIR CORRESPONDING DETECTION LIMITS.
3. NS INDICATES MONITORING WELL WAS NOT SAMPLED. MW2 WAS NOT SAMPLED DURING THE EXPEDITED SAMPLING EVENT DUE TO DAMAGE TO WELL CASING. MW18 WAS NOT SAMPLED PRIOR TO THE EXPEDITED SAMPLING EVENT.
4. TOTAL VOC ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
5. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
6. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

FIGURE 2-18

Developed By ACC,DAP — Drawn By JSL,TPB
Approved By — Date 8/17/95
Reference
Revisions

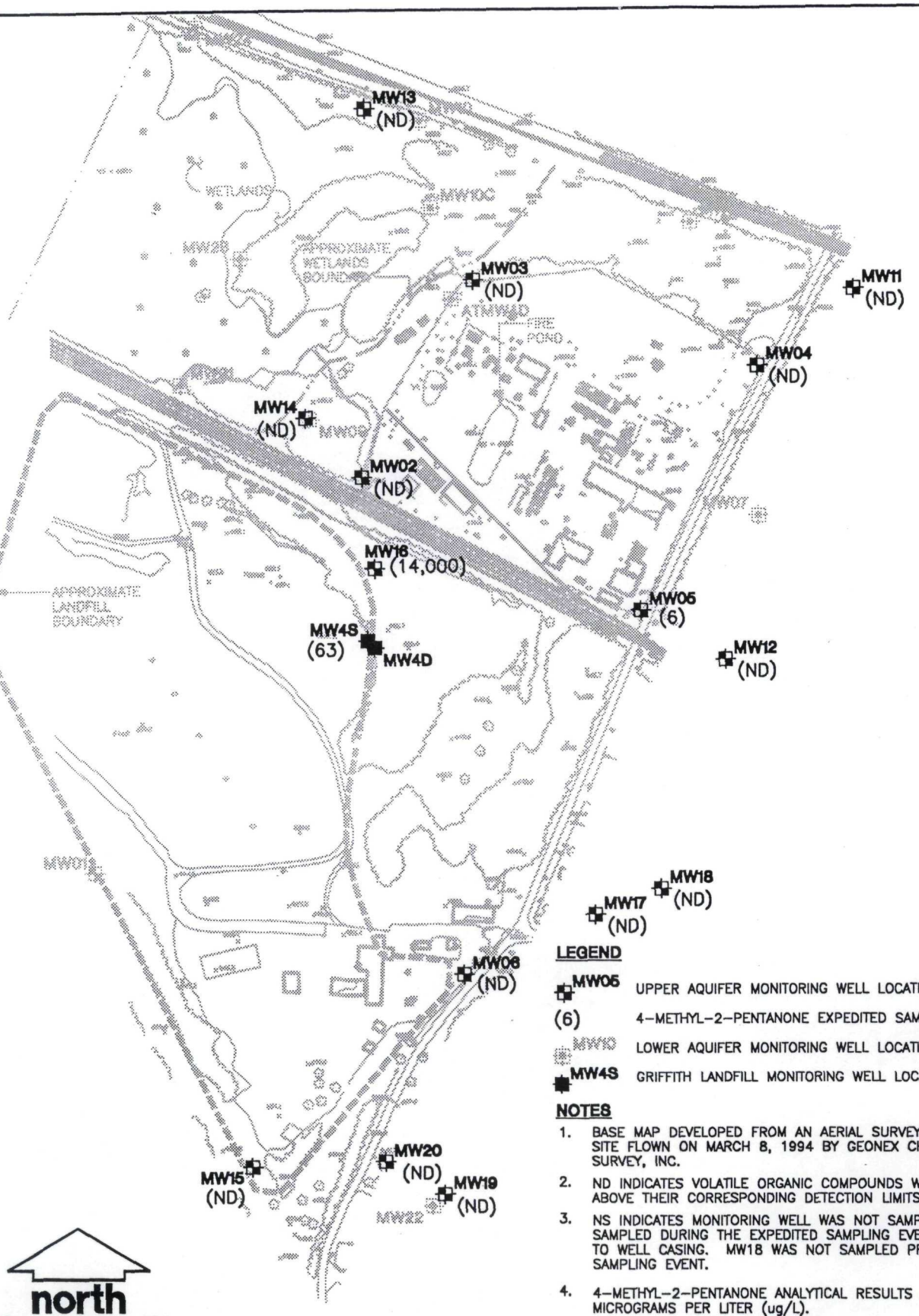
UPPER AQUIFER 1,2-DICHLOROETHENE CONCENTRATION MAP (ug/L)

PRE–DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 **A38**

MONTGOMERY WATSON

Management Review: Other
Technical Review: Project Manager
QUALITY CONTROL: Graphic Standards, Lead Professional



LEGEND

- MW05 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- (6) — 4-METHYL-2-PENTANONE EXPEDITED SAMPLING RESULTS (ug/L)
- MW10 — LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW4S — GRIFFITH LANDFILL MONITORING WELL LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES VOLATILE ORGANIC COMPOUNDS WERE NOT DETECTED ABOVE THEIR CORRESPONDING DETECTION LIMITS.
3. NS INDICATES MONITORING WELL WAS NOT SAMPLED. MW2 WAS NOT SAMPLED DURING THE EXPEDITED SAMPLING EVENT DUE TO DAMAGE TO WELL CASING. MW18 WAS NOT SAMPLED PRIOR TO THE EXPEDITED SAMPLING EVENT.
4. 4-METHYL-2-PENTANONE ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
5. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
6. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

FIGURE 2-19

Developed By ACC/DAP — Drawn By JSL,TPB
Approved By — Date 8/17/95
Reference
Revisions

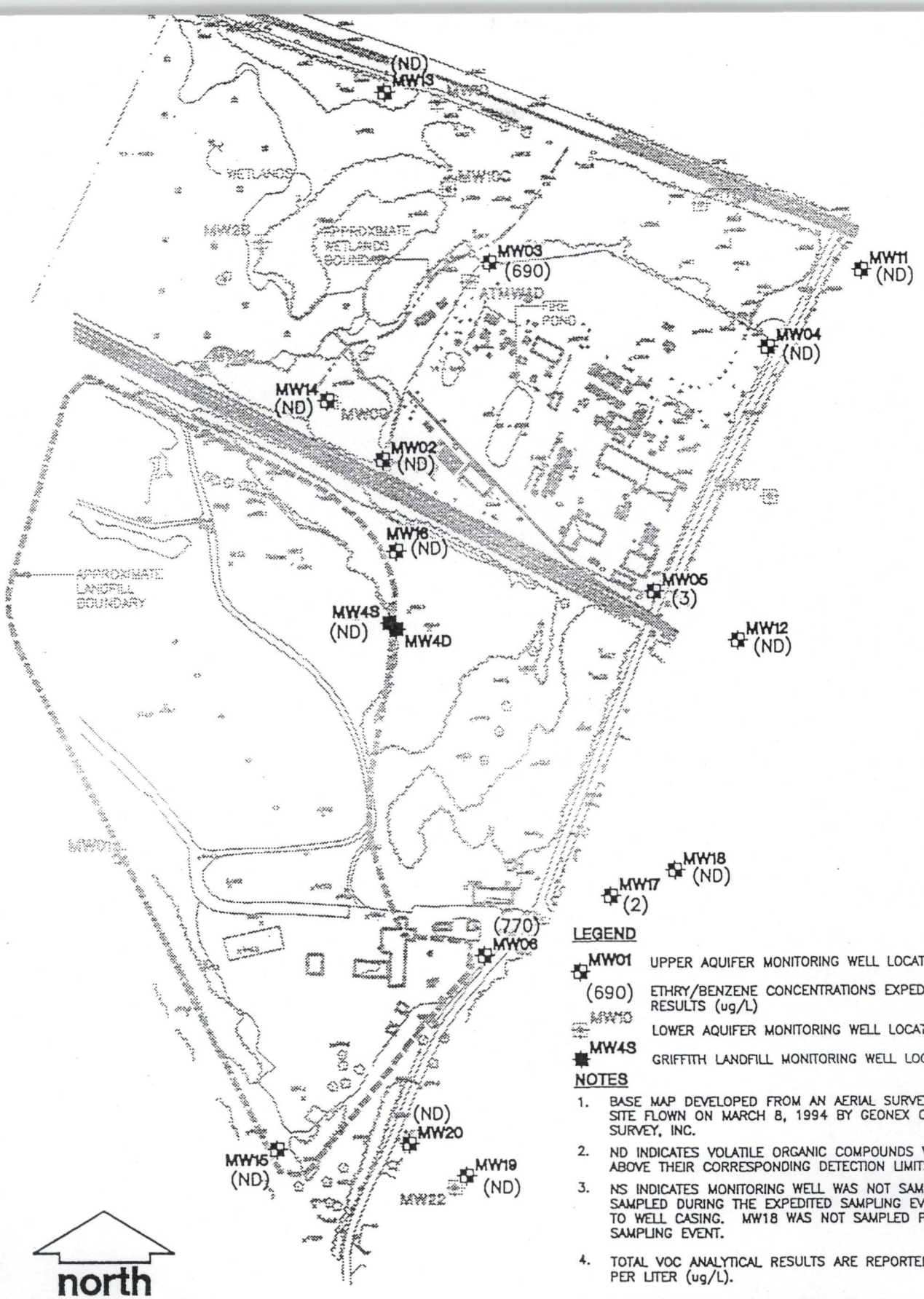
UPPER AQUIFER 4-METHYL-2-PENTANONE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 **A39**

MONTGOMERY WATSON

Management Review — Other
Technical Review — Project Manager
Graphic Standards — Lead Professional
QUALITY CONTROL



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- (690) — ETHRY/BENZENE CONCENTRATIONS EXPEDITED SAMPLING RESULTS (ug/L)
- MW13 — LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW4S — GRIFFITH LANDFILL MONITORING WELL LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES VOLATILE ORGANIC COMPOUNDS WERE NOT DETECTED ABOVE THEIR CORRESPONDING DETECTION LIMITS.
3. NS INDICATES MONITORING WELL WAS NOT SAMPLED. MW2 WAS NOT SAMPLED DURING THE EXPEDITED SAMPLING EVENT DUE TO DAMAGE TO WELL CASING. MW18 WAS NOT SAMPLED PRIOR TO THE EXPEDITE SAMPLING EVENT.
4. TOTAL VOC ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
5. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
6. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

FIGURE 2-20

Developed By DAP Drawn By JSL
Approved By [signature] Date 8/11/95
Reference
Revisions

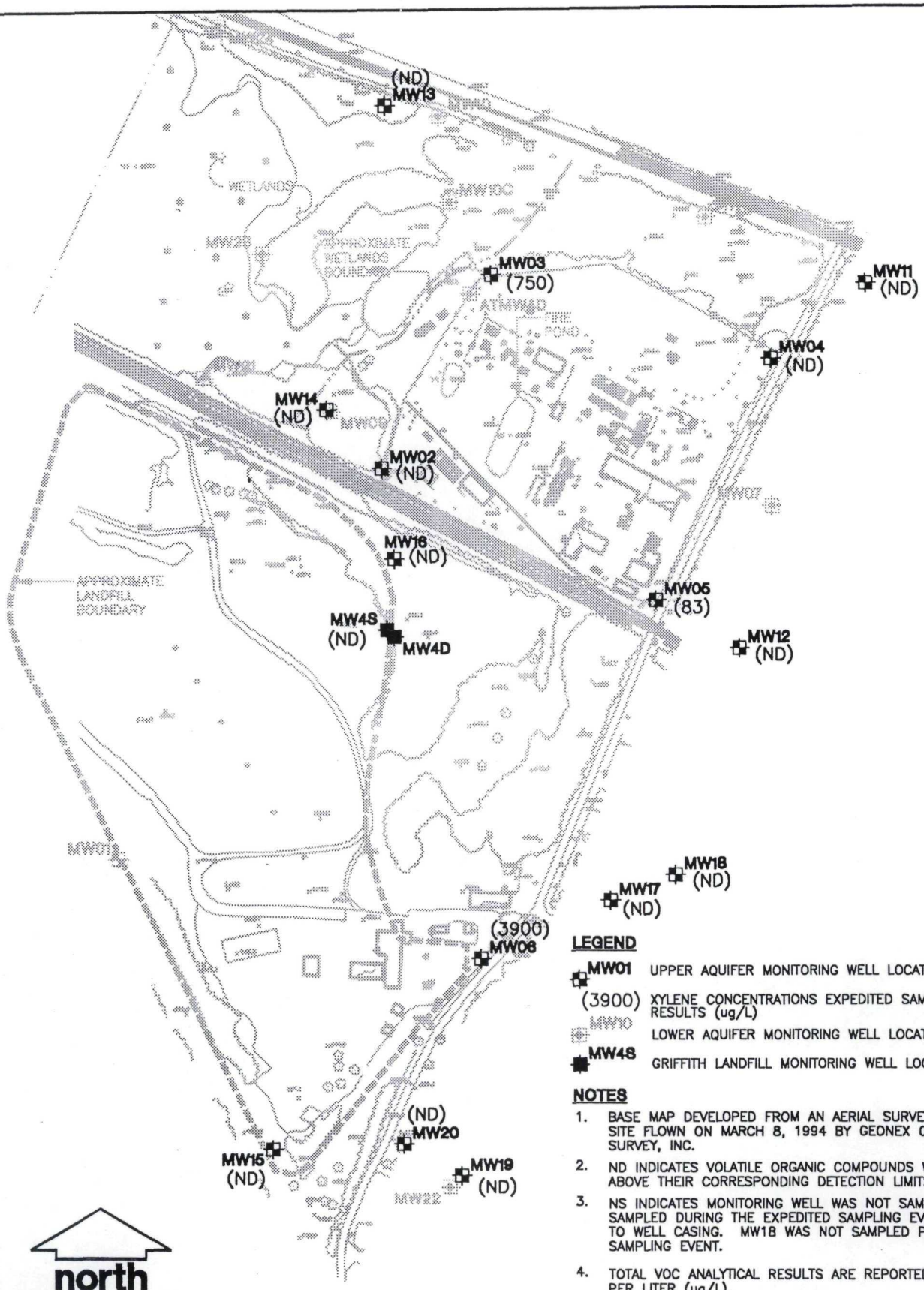
UPPER AQUIFER ETHYL BENZENE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 A41

MONTGOMERY WATSON

Management Review: Other
Technical Review: Project Manager
Graphic Standards: Lead Professional
QUALITY CONTROL



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- (3900) — XYLENE CONCENTRATIONS EXPEDITED SAMPLING RESULTS (ug/L)
- MW10 — LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW4S — GRIFFITH LANDFILL MONITORING WELL LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES VOLATILE ORGANIC COMPOUNDS WERE NOT DETECTED ABOVE THEIR CORRESPONDING DETECTION LIMITS.
3. NS INDICATES MONITORING WELL WAS NOT SAMPLED. MW2 WAS NOT SAMPLED DURING THE EXPEDITED SAMPLING EVENT DUE TO DAMAGE TO WELL CASING. MW18 WAS NOT SAMPLED PRIOR TO THE EXPEDITED SAMPLING EVENT.
4. TOTAL VOC ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
5. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
6. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

north

0 400

SCALE IN FEET

FIGURE 2-21

Developed By ACC, DAP — Drawn By JSL

Approved By — Date 8/17/95

Reference

Revisions

UPPER AQUIFER XYLENE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

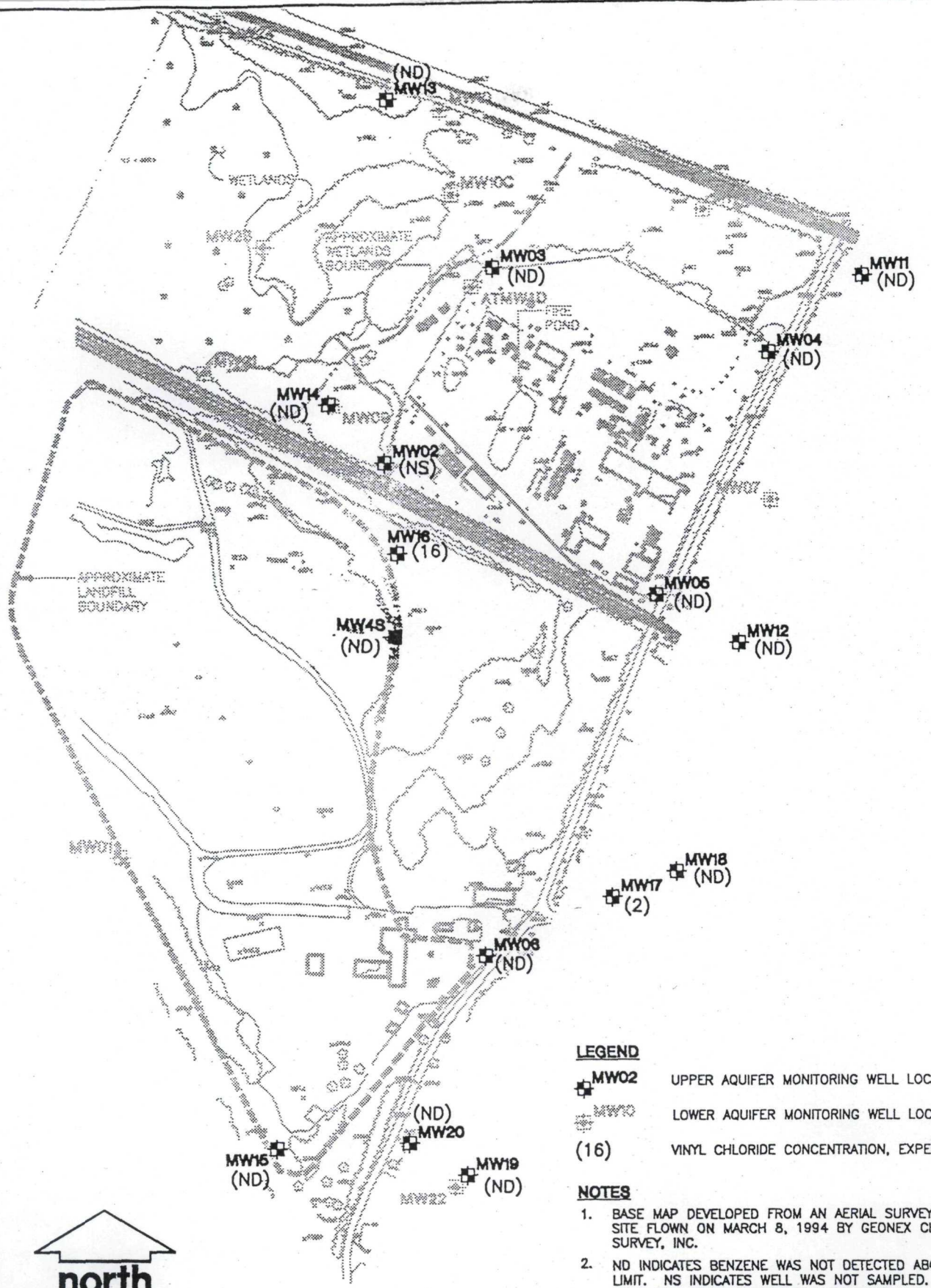
Drawing Number 4077.0030 **A42**

MONTGOMERY WATSON

Management Review — Other

Technical Review — Project Manager

QUALITY CONTROL — Graphic Standards — Lead Professional



LEGEND

MW02	UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
MW10	LOWER AQUIFER MONITORING WELL LOCATION AND NUMBER
(16)	VINYL CHLORIDE CONCENTRATION, EXPEDITED SAMPLING (ug/L)

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES BENZENE WAS NOT DETECTED ABOVE THE DETECTION LIMIT. NS INDICATES WELL WAS NOT SAMPLED. MW02 WAS NOT SAMPLED DUE TO DAMAGE TO WELL CASING.
3. BENZENE ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).

north

0 400

SCALE IN FEET

FIGURE 2-22

Developed By ACC, DAP
Drawn By JSL
Approved By
Date 8/17/95
Reference
Revisions

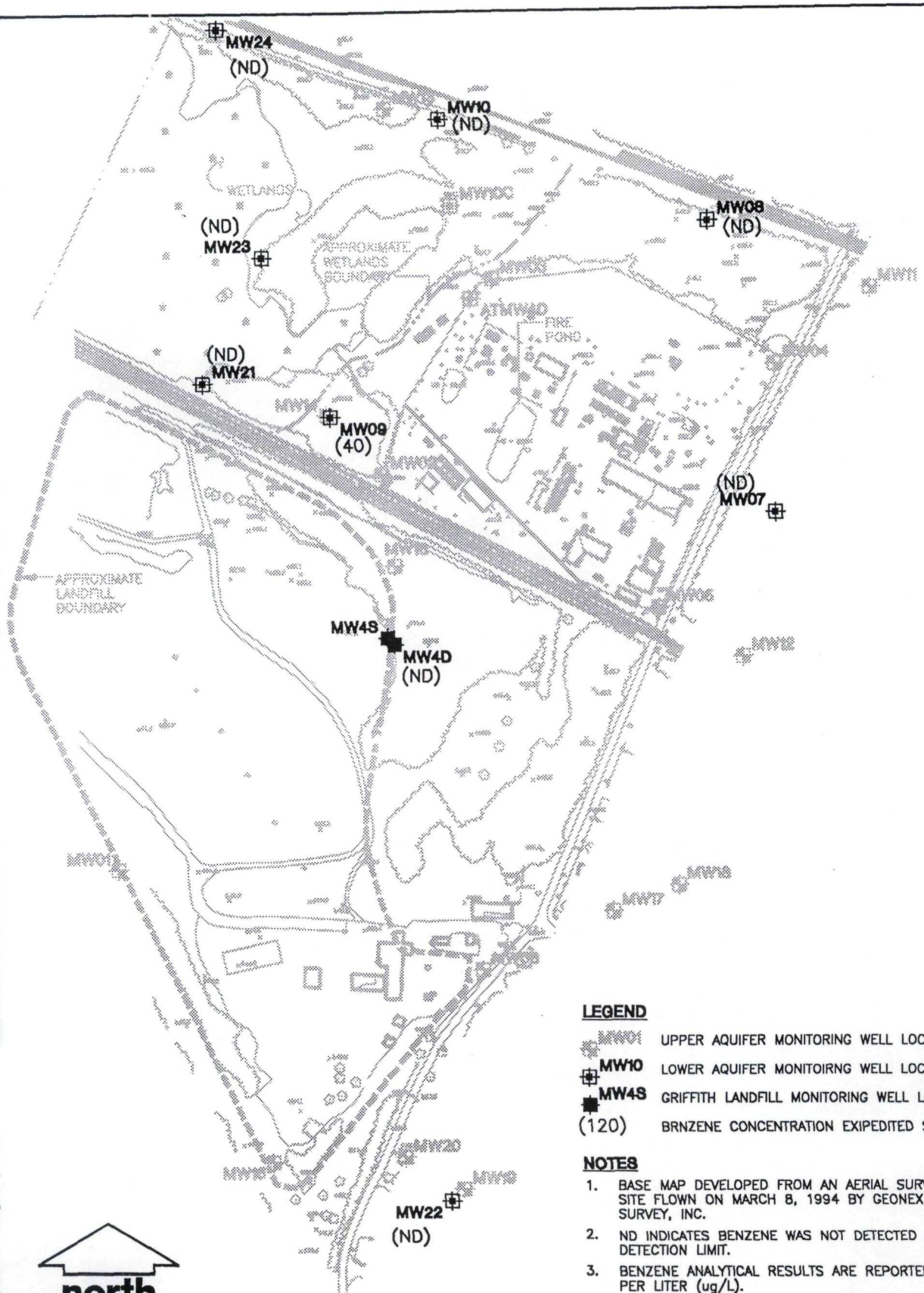
UPPER AQUIFER VINYL CHLORIDE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
4077.0030 A46

MONTGOMERY WATSON

Management Review | Other
Technical Review | Project Manager
Graphic Standards | Lead Professional
QUALITY CONTROL



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW10 — LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- MW4S — GRIFFITH LANDFILL MONITORING WELL LOCATION AND NUMBER
- (120) — BRNZENE CONCENTRATION EXIPEDITED SAMPLING (ug/L)

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES BENZENE WAS NOT DETECTED ABOVE THE DETECTION LIMIT.
3. BENZENE ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
4. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
5. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

north

0 400

SCALE IN FEET

FIGURE 2-23

Developed By ACC,DAP Drawn By JSL,TPB

Approved By [signature] Date 8/17/95

Reference

Revisions

LOWER AQUIFER BENZENE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 **A35**

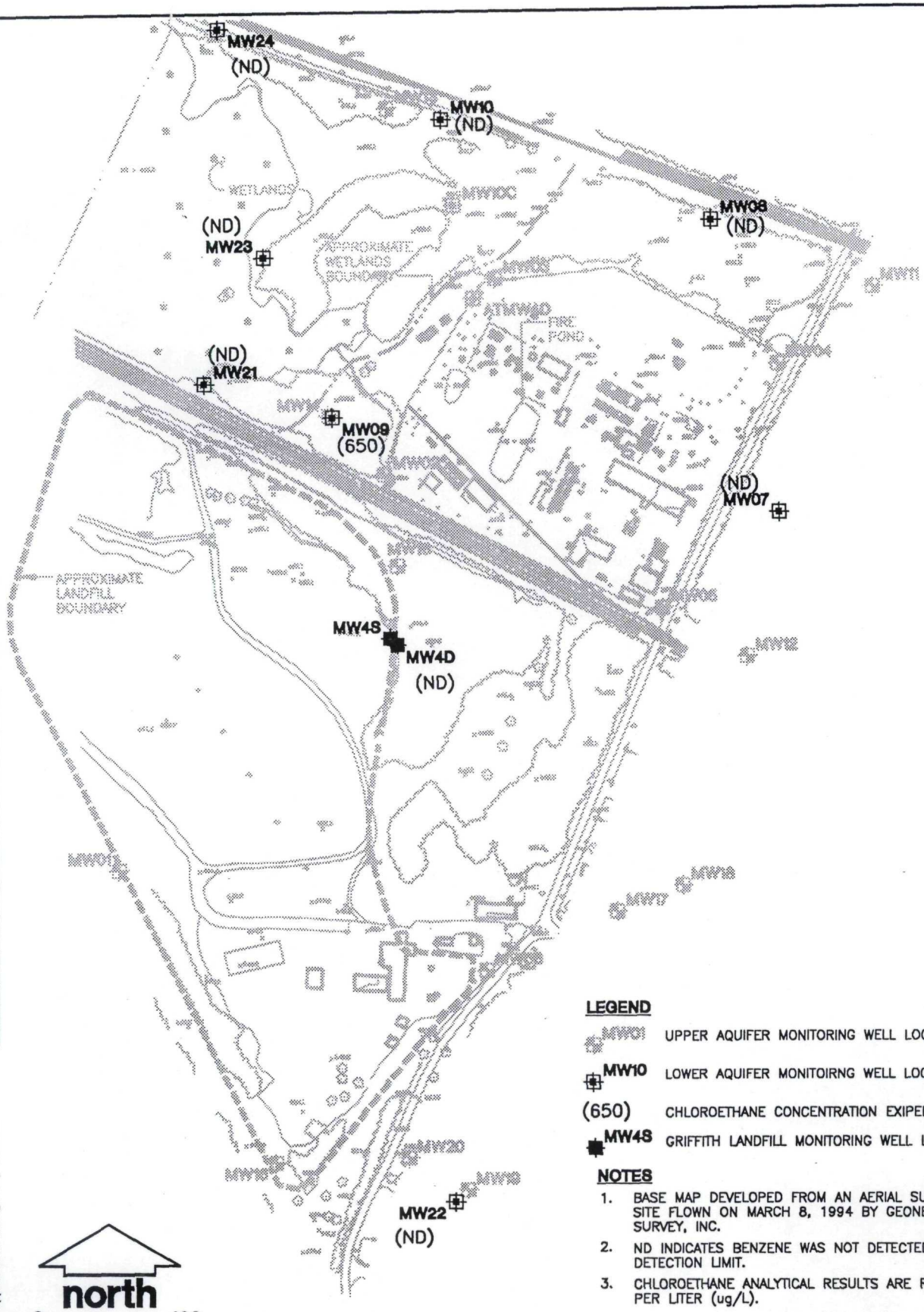
MONTGOMERY WATSON

Management Review — Other

Technical Review — Project Manager

Graphic Standards — Lead Professional

QUALITY CONTROL



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW10 — LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- (650) — CHLOROETHANE CONCENTRATION EXIPEDITED SAMPLING (ug/L)
- MW4S — GRIFFITH LANDFILL MONITORING WELL LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES BENZENE WAS NOT DETECTED ABOVE THE DETECTION LIMIT.
3. CHLOROETHANE ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
4. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
5. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

north

0 400

SCALE IN FEET

FIGURE 2-24

Developed By DAP Drawn By JSL

Approved By Date 8/17/95

Reference

Revisions

LOWER AQUIFER CHLOROETHANE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

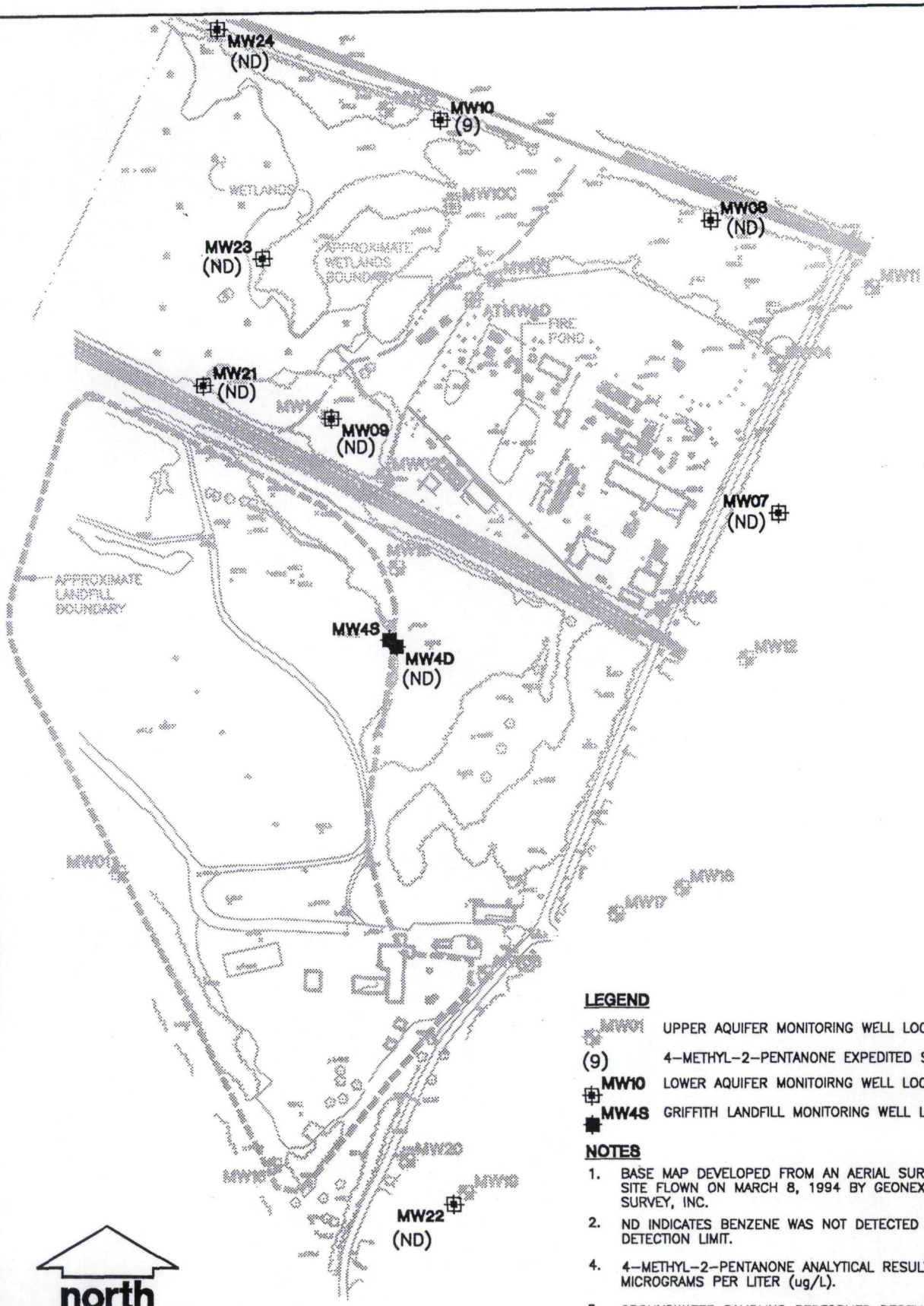
Drawing Number 4077.0030 **A37**

MONTGOMERY WATSON

Management Review — Other

Technical Review — Project Manager

QUALITY CONTROL — Graphic Standards — Lead Professional



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- (9) — 4-METHYL-2-PENTANONE EXPEDITED SAMPLING RESULTS (ug/L)
- MW10 — LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- MW4S — GRIFFITH LANDFILL MONITORING WELL LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. ND INDICATES BENZENE WAS NOT DETECTED ABOVE THE DETECTION LIMIT.
4. 4-METHYL-2-PENTANONE ANALYTICAL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L).
5. GROUNDWATER SAMPLING PERFORMED DECEMBER 30, 1994 THROUGH JANUARY 5, 1995.
6. GRIFFITH LANDFILL MONITORING WELLS MW4D AND MW4S WERE SAMPLED ON JANUARY 26, 1995.

north

0 400

SCALE IN FEET

FIGURE 2-25

Developed By ACC/DAP Drawn By JSL,TPB

Approved By Date 8/17/95

Reference

Revisions

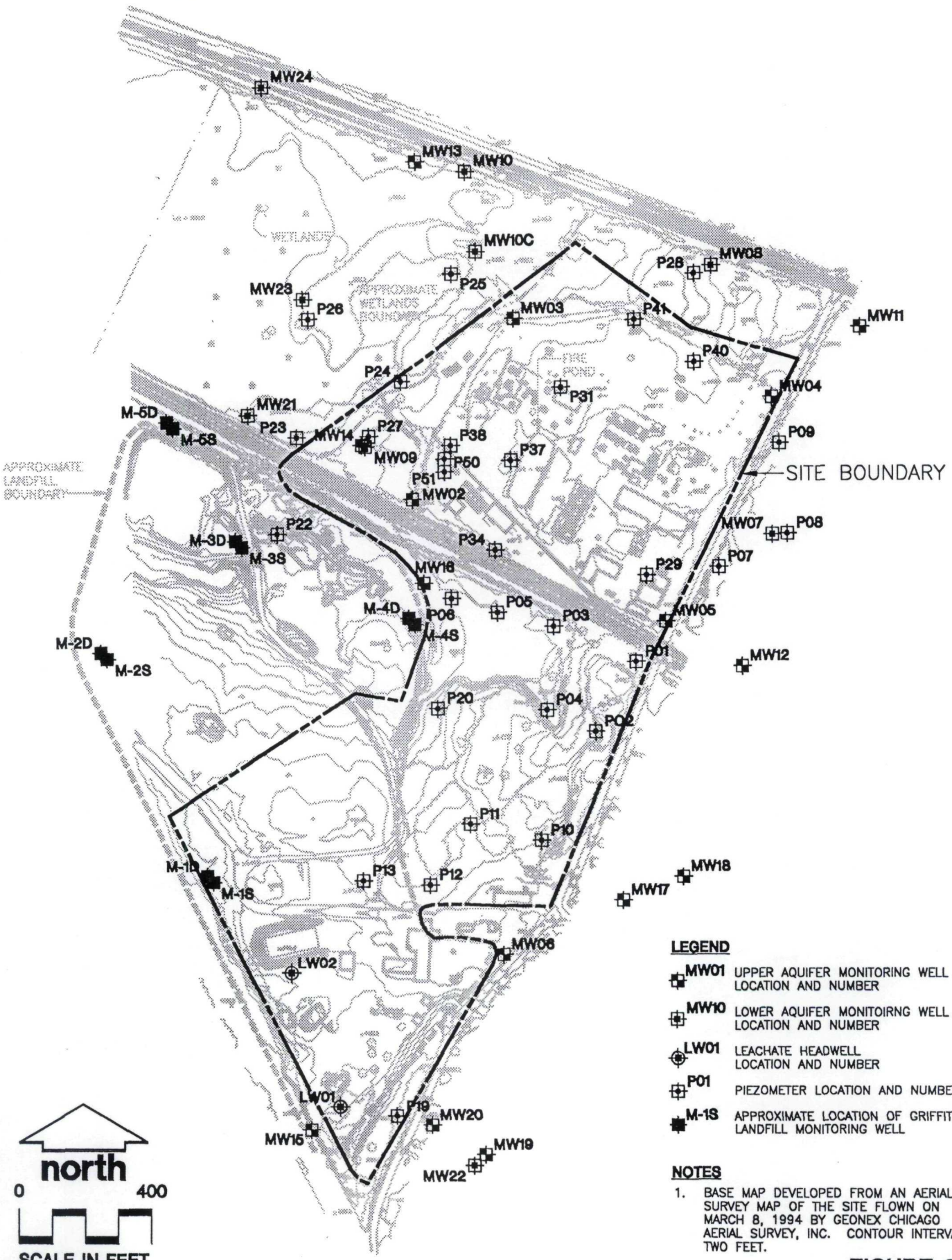
LOWER AQUIFER 4-METHYL-2-PENTANONE CONCENTRATION MAP (ug/L)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 **A40**

MONTGOMERY WATSON

Management Review — Other
Technical Review — Project Manager
QUALITY CONTROL — Graphic Standards — Lead Professional



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW10 — LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- LW01 — LEACHATE HEADWELL LOCATION AND NUMBER
- P01 — PIEZOMETER LOCATION AND NUMBER
- M-1S — APPROXIMATE LOCATION OF GRIFFITH LANDFILL MONITORING WELL

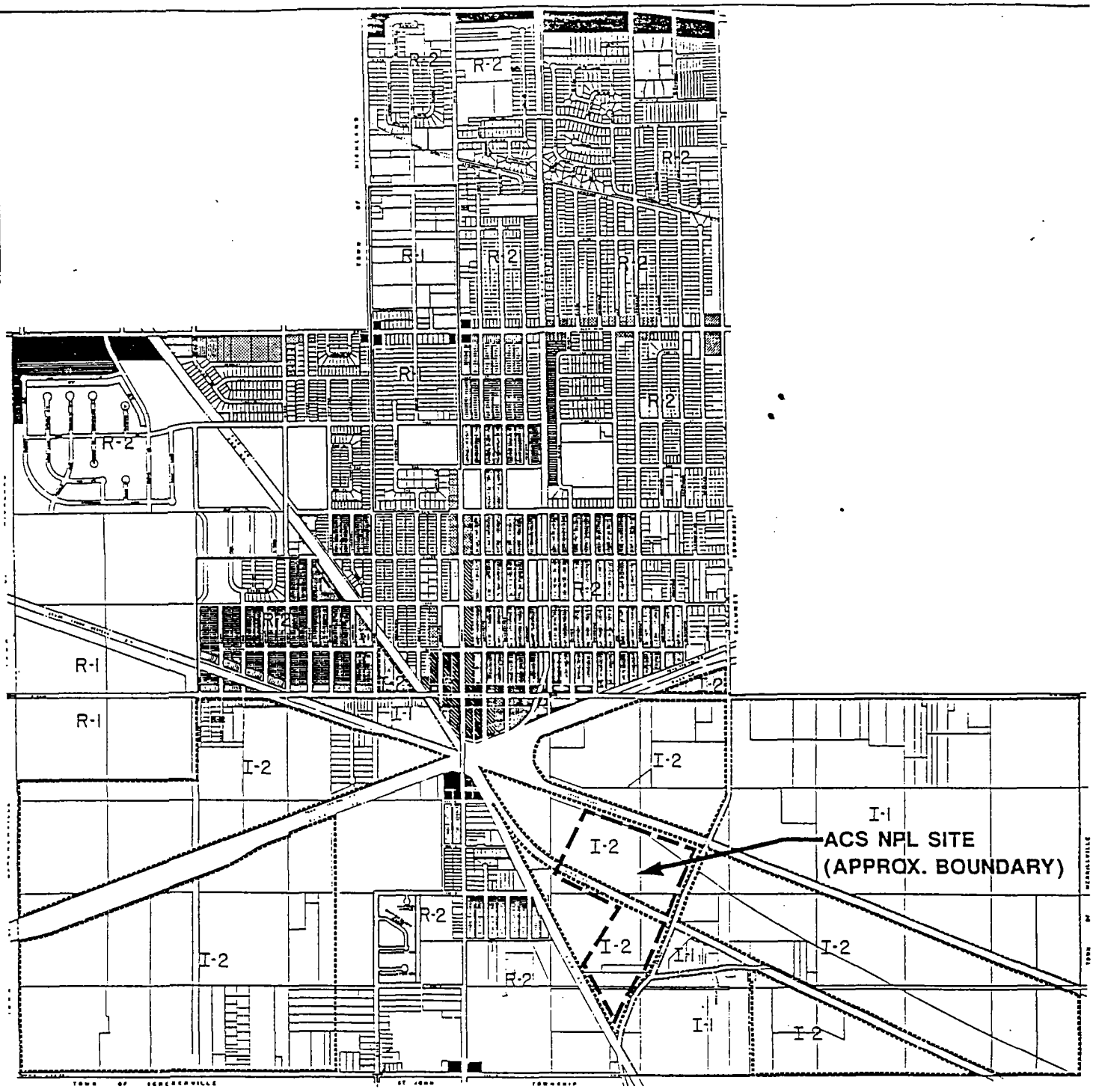
NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC. CONTOUR INTERVAL TWO FEET.

FIGURE 2-26

Management Review: Other
Technical Review: Project Manager
Graphic Standards: Lead Professional
QUALITY CONTROL

Developed By DAP	Drawn By JSL	**SITE BOUNDARY**	Drawing Number 4077.0030 **A43**
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	**MONTGOMERY WATSON**
Reference			
Revisions			



RESIDENTIAL DISTRICTS

- R-1 R-1 ONE-FAMILY
- R2 R-2 ONE-FAMILY
- R T TWO-FAMILY
- RM-1 MULTIPLE-FAMILY
- RM-2 MEDIUM DENSITY MULTI-FAMILY

NON-RESIDENTIAL DISTRICTS

- O3-1 OFFICE SERVICE
- B-1 LOCAL BUSINESS
- B-2 CENTRAL BUSINESS
- B-3 GENERAL BUSINESS
- RO RESEARCH OFFICE
- I-1 LIGHT INDUSTRIAL
- I-2 GENERAL INDUSTRIAL
- P-1 VEHICULAR PARKING
- B-4 COMMERCIAL DISTRICT

north

0 2000 4000

SCALE IN FEET

NOTES

1. BASE MAP DEVELOPED FROM ZONING DISTRICT MAP PROVIDED BY THE TOWN OF GRIFFITH, INDIANA, DATED APRIL, 1978. REVISED FEBRUARY 5, 1986 & JUNE 27, 1989 BY TORRENGA ENGINEERING, INC.

FIGURE 2-27

Developed By	Drawn By TPB	ZONING MAP
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA
Reference		Drawing Number 4077.0030 A5
Revisions		MONTGOMERY WATSON

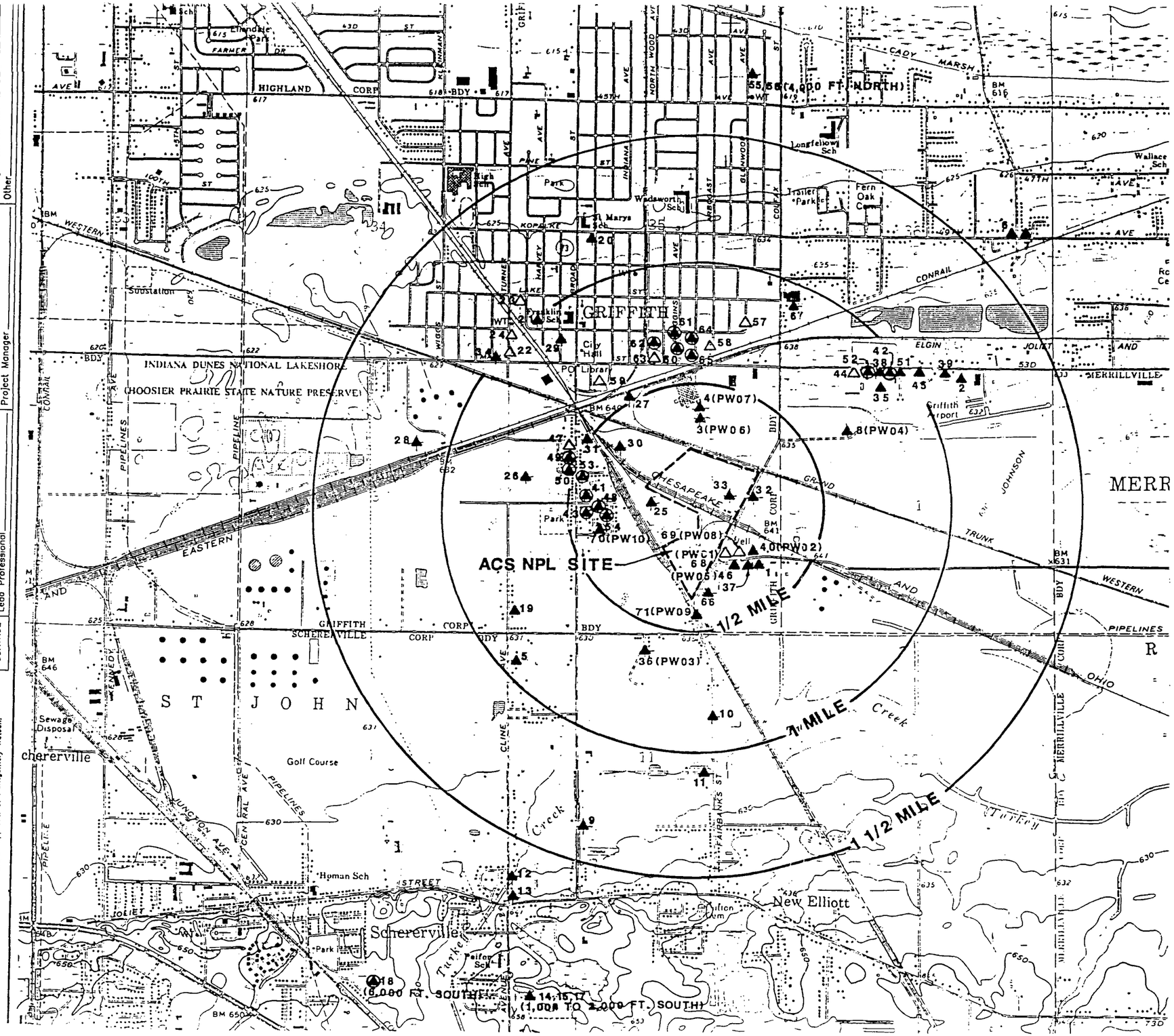


FIGURE **2-28**

LEGEND

- ⊛ UPPER AQUIFER PRIVATE WELL LOCATION
- ▲ LOWER AQUIFER PRIVATE WELL LOCATION
- △ UNKNOWN AQUIFER PRIVATE WELL LOCATION
- (PW01) PRIVATE WELL SAMPLING LOCATION

NOTES

1. BASE MAP DEVELOPED FROM HIGHLAND AND ST. JOHN, INDIANA 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAPS DATED 1968 AND 1962 RESPECTIVELY, PHOTOREVISED 1980.
2. PRIVATE WELL DATA WAS OBTAINED FROM THE INDIANA DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER WELL LOGS, OR A U.S.EPA SURVEY, OR A WARZYN DOOR TO DOOR SURVEY.

Developed By PMS, DAP Drawn By DLL,TMS,LCL,TPB
Approved By M. Montgomery Date 2-6-95
Reference MANUAL DRAWING 60251-B18
Revisions

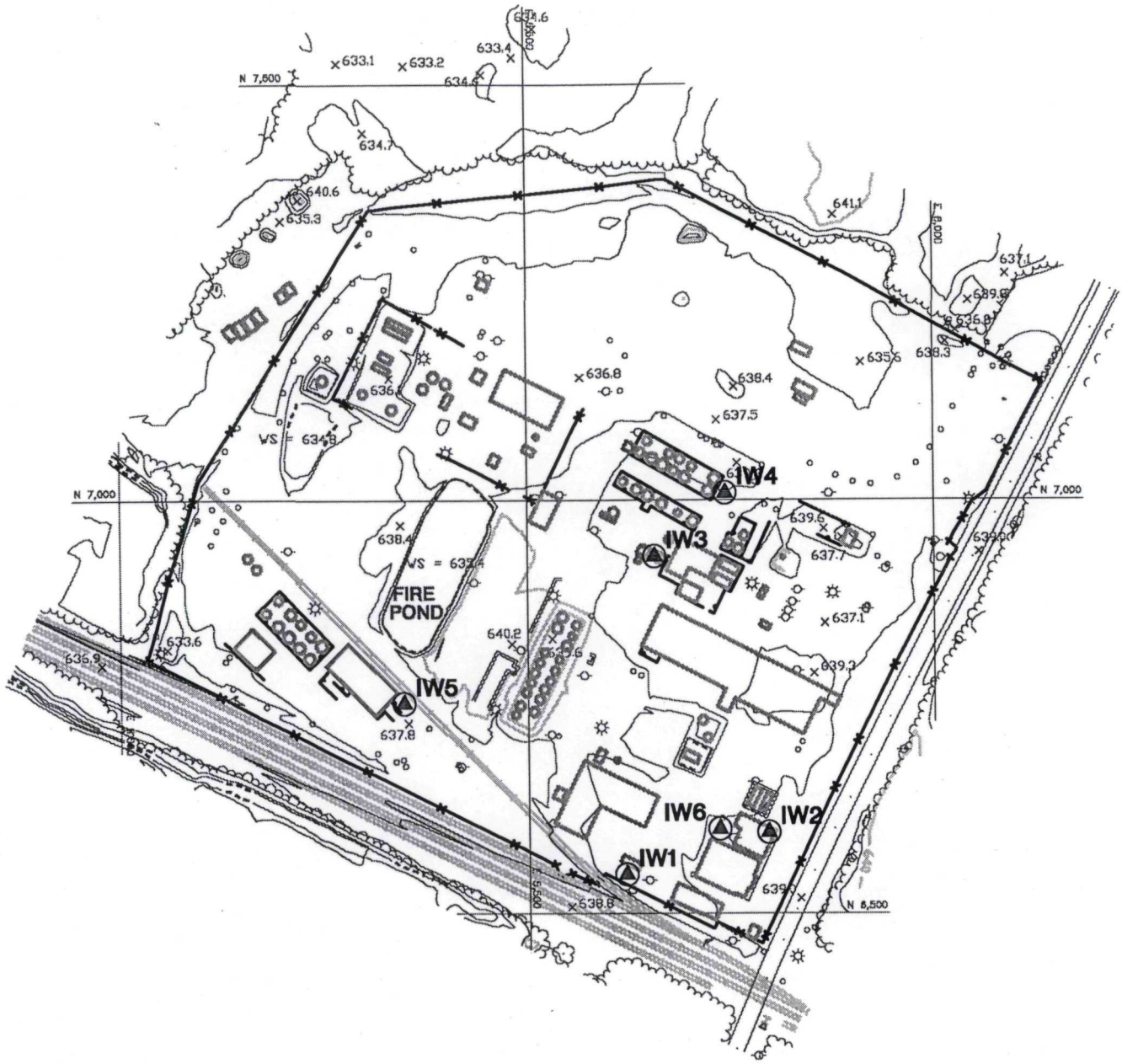
PRIVATE WELL LOCATION MAP

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 B8

MONTGOMERY WATSON

Management Review: Other
Technical Review: Project Manager
QUALITY CONTROL: Graphic Standards; Lead Professional



LEGEND

- IW1 — INDUSTRIAL WATER WELL LOCATION AND NUMBER
- FENCE LINE
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2ft.
3. WELLS NUMBER 5 AND 6 ARE INACTIVE.

north

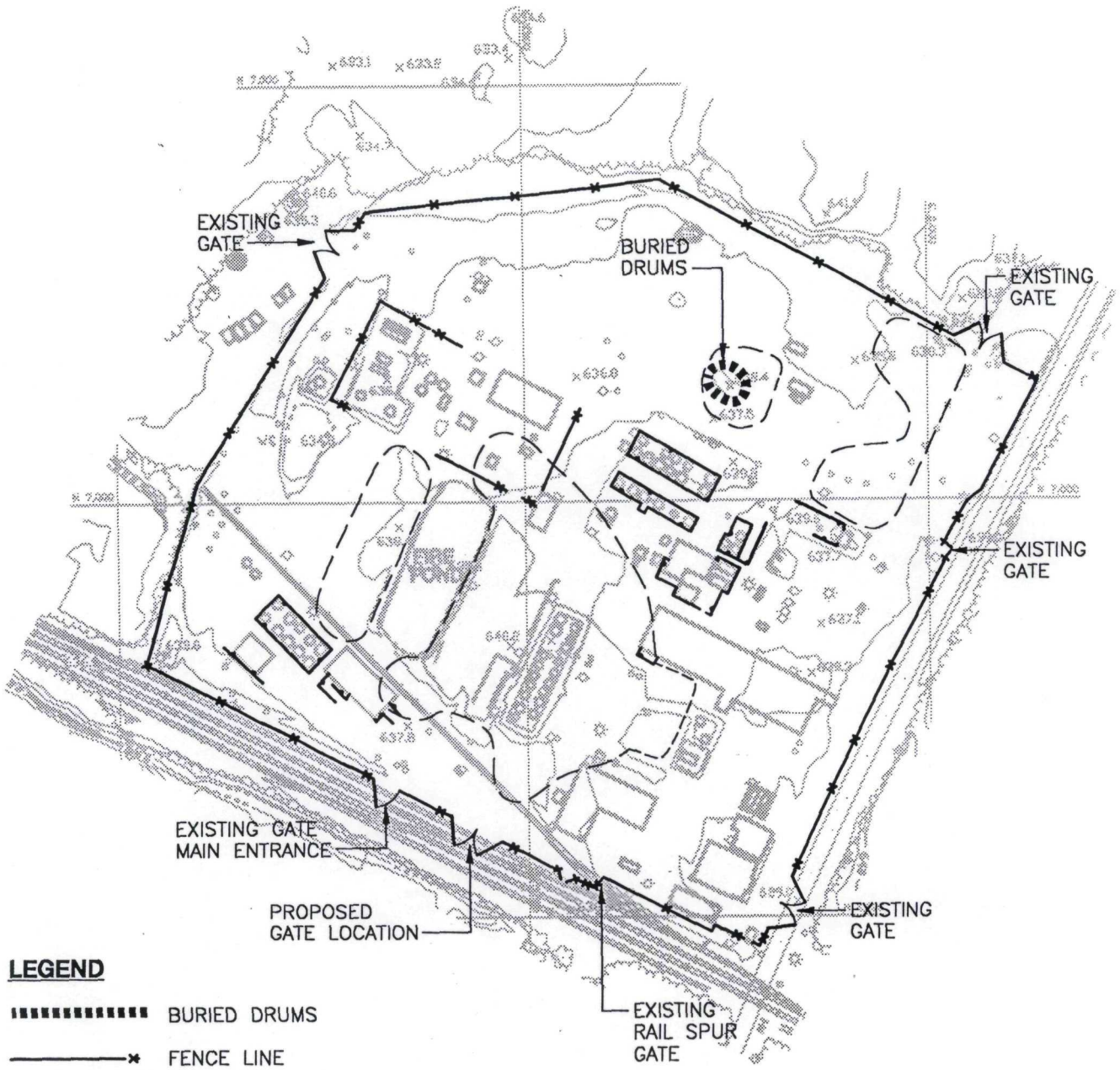
0 200 400

SCALE IN FEET

FIGURE 2-29

Developed By PMS/DAP	Drawn By TMS,TPB,LCL	**PRODUCTION WELL LOCATION MAP**	Drawing Number 4077.0030 **A48**
Approved By [signature]	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	**MONTGOMERY WATSON**
Reference			
Revisions 1 IW5 AND IW6 RELOCATED. 08-13-95			

QUALITY CONTROL: Graphic Standards / Lead Professional; Technical Review / Project Manager; Management Review / Other



LEGEND

- BURIED DRUMS
- FENCE LINE
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF KNOWN SOIL CONTAMINATION

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.

north

0 200 400

SCALE IN FEET

FIGURE 3-1

Developed By PMS, DAP Drawn By TMS, TPB

Approved By [signature] Date 8/17/95

Reference

Revisions

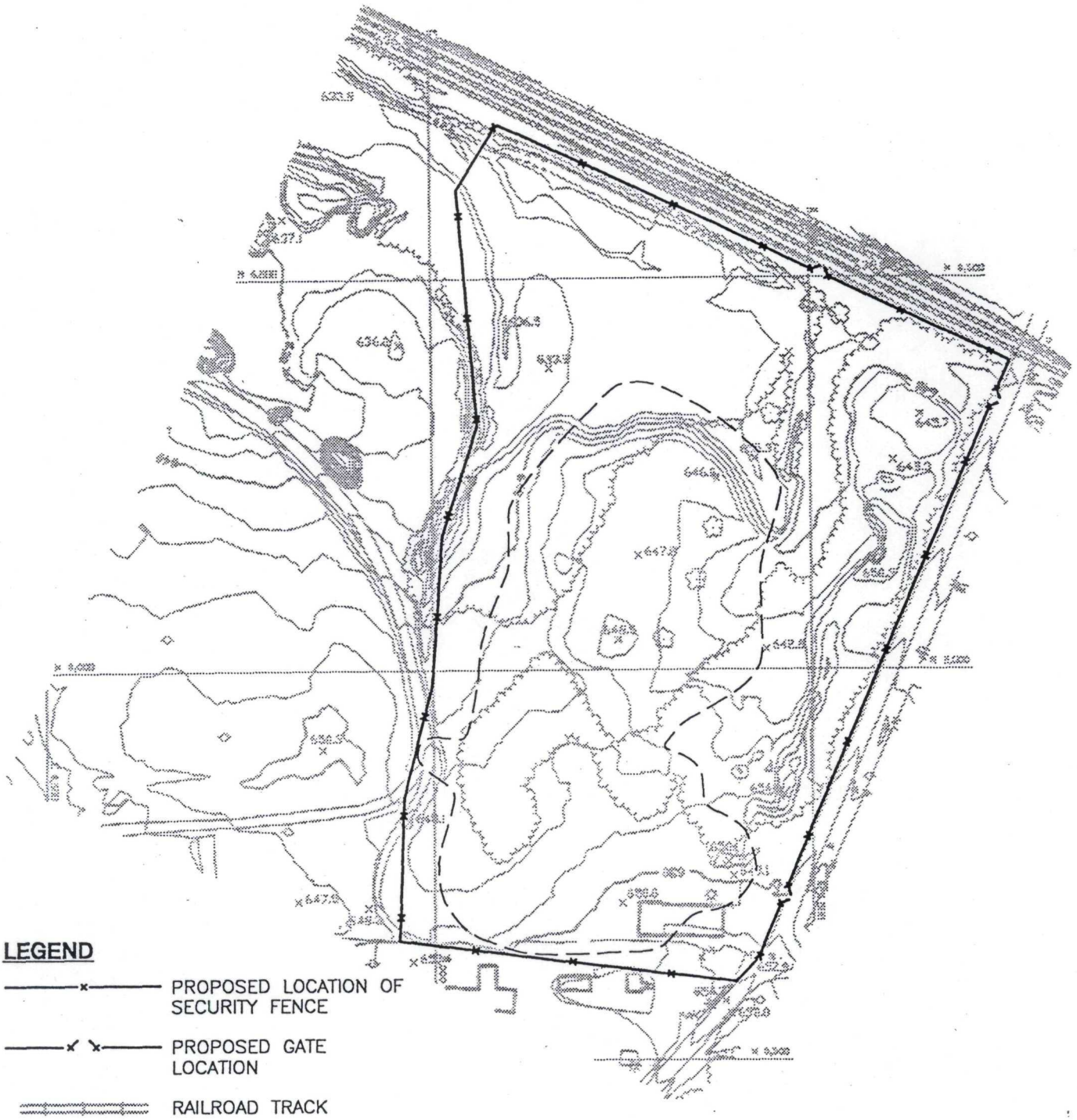
EXISTING SECURITY FENCE LOCATION MAP

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 **A6**

MONTGOMERY WATSON

QUALITY CONTROL: Graphic Standards — Lead Professional; Technical Review — Project Manager; Management Review — Other



LEGEND

- PROPOSED LOCATION OF SECURITY FENCE
- PROPOSED GATE LOCATION
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF CONTAMINATED SOIL

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.

north

0 200 400

SCALE IN FEET

FIGURE 3-2

Developed By PMS, DAP	Drawn By TMS, TPB	PROPOSED SECURITY FENCE LOCATION MAP	Drawing Number 4077.0030 A7
Approved By [signature]	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	MONTGOMERY WATSON
Reference			
Revisions			

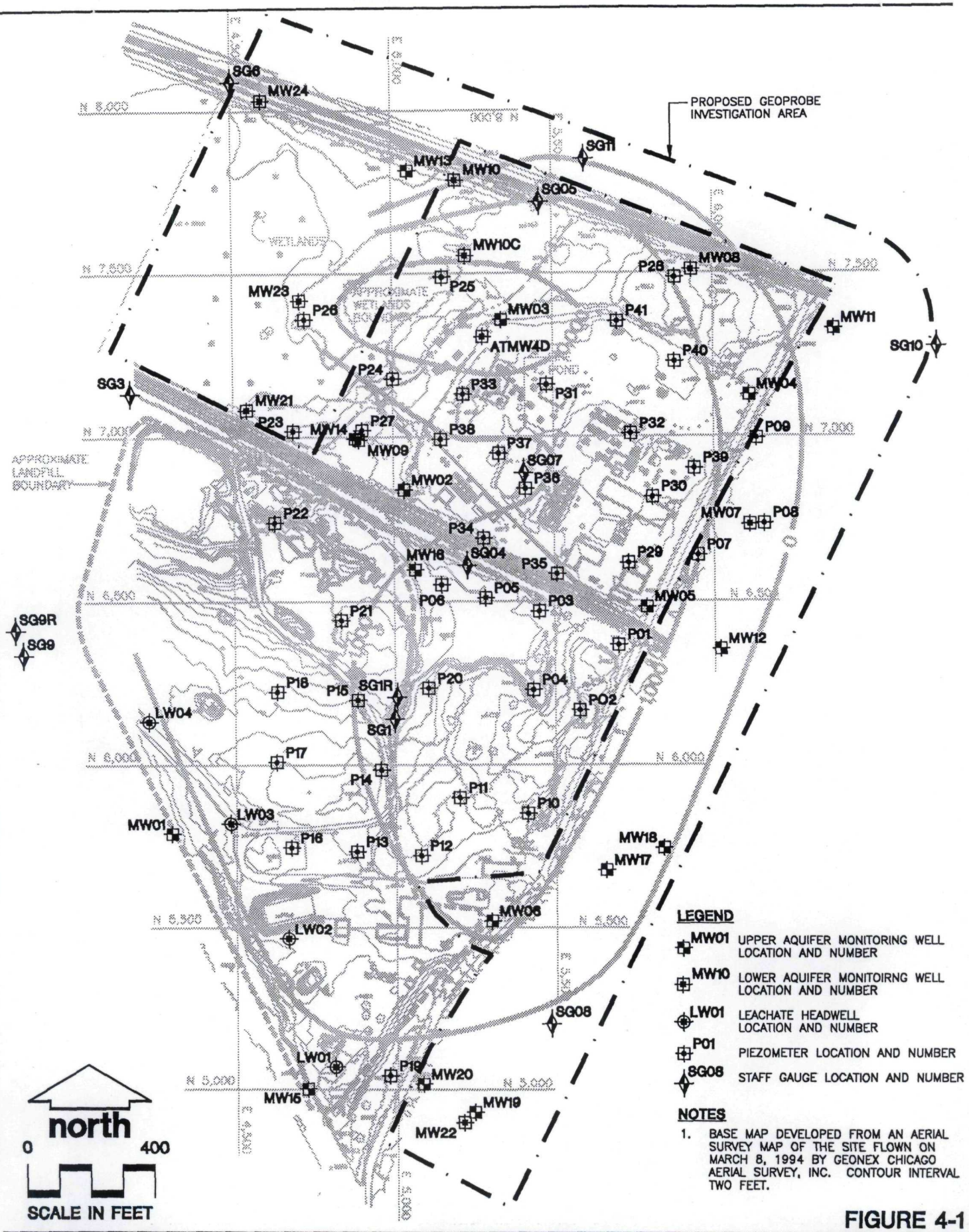


FIGURE 4-1

Management Review: Other
Technical Review: Project Manager
Graphic Standards: Lead Professional
QUALITY CONTROL

Developed By PMS,DAP,MJH	Drawn By TMS,LCL,TPB	PROPOSED TRACER GROUNDWATER INVESTIGATION AREA	Drawing Number 4077.0030 A8
Approved By [signature]	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	MONTGOMERY WATSON
Reference			
Revisions			

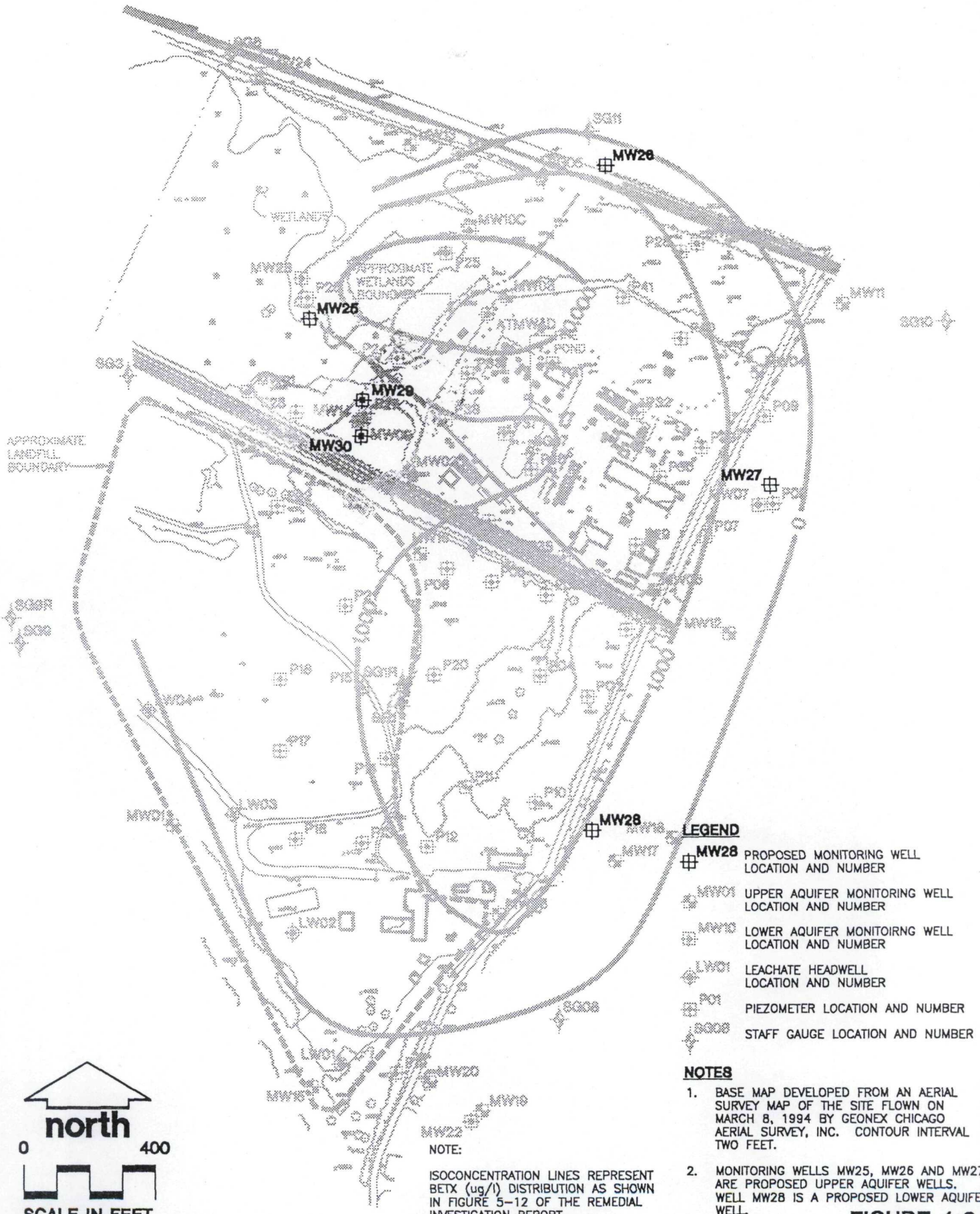
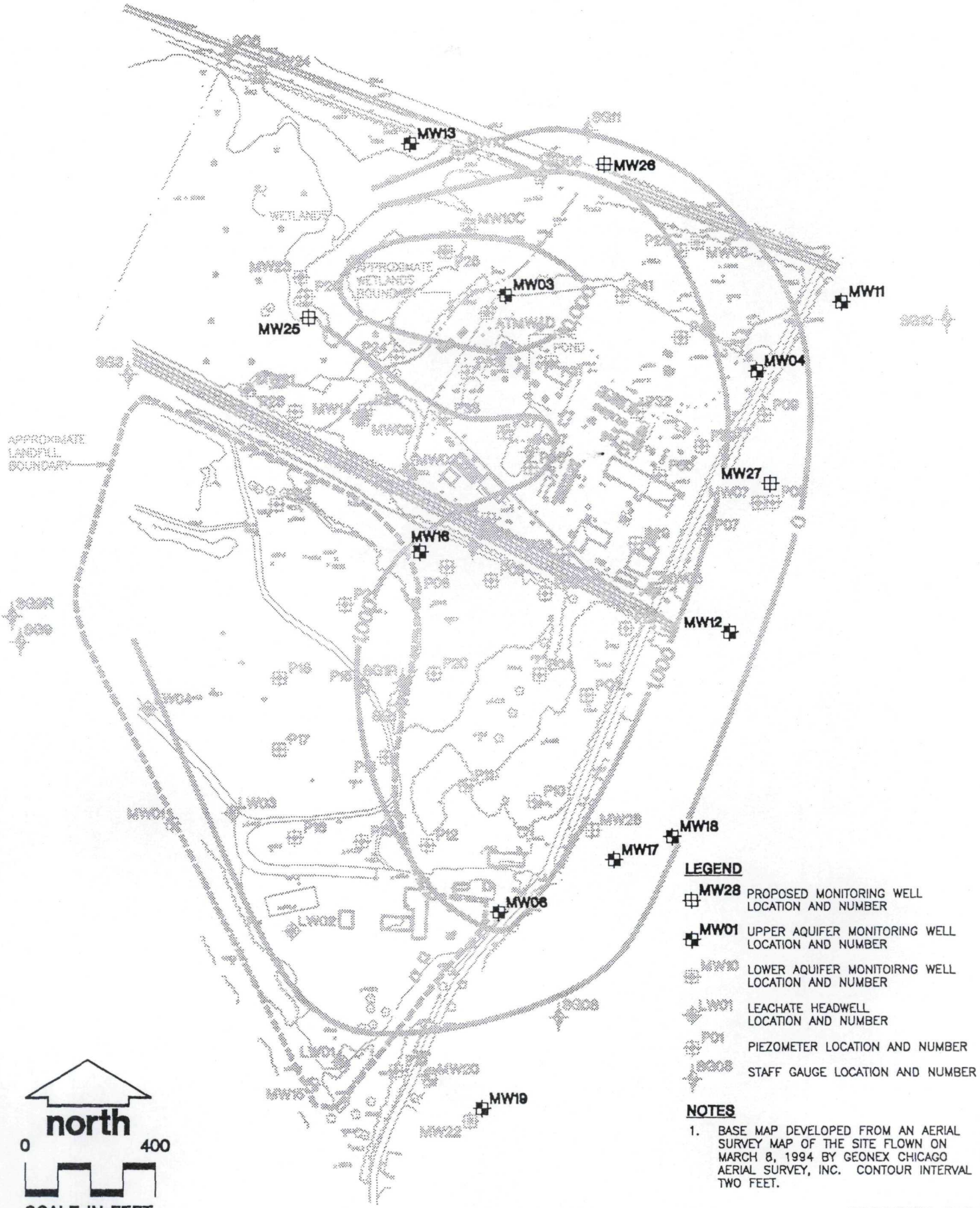


FIGURE 4-2

Management Review
Other
Technical Review
Project Manager
Graphic Standards
Lead Professional
QUALITY CONTROL

Developed By PMS,DAP,MJH	Drawn By TMS,LCL,TPB	**PROPOSED MONITORING WELL LOCATION MAP**	Drawing Number 4077.0030 **A9**
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	**MONTGOMERY WATSON**
Reference			
Revisions			



LEGEND

- MW28 — PROPOSED MONITORING WELL LOCATION AND NUMBER
- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW20 — LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- LW01 — LEACHATE HEADWELL LOCATION AND NUMBER
- P01 — PIEZOMETER LOCATION AND NUMBER
- SG08 — STAFF GAUGE LOCATION AND NUMBER

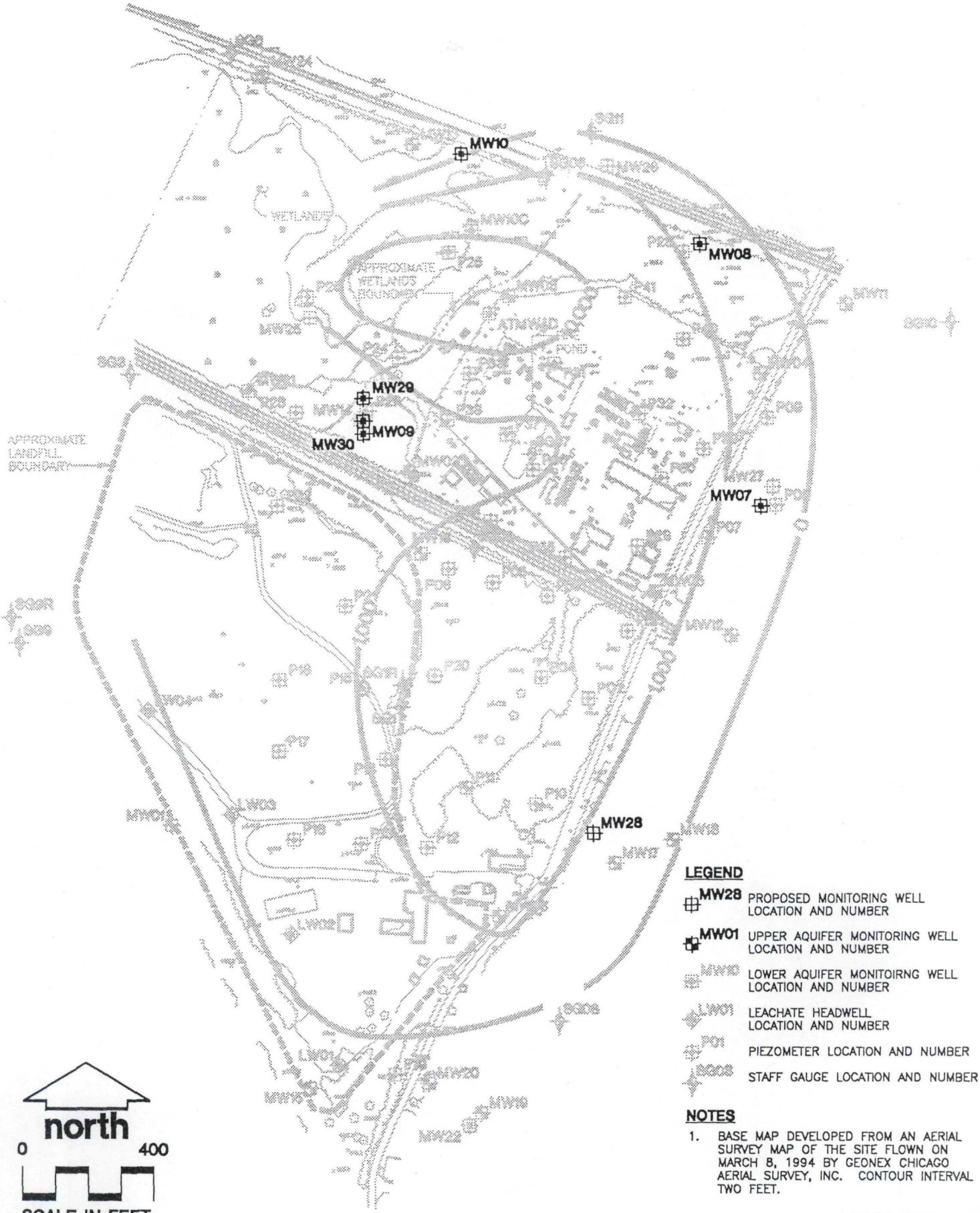
NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC. CONTOUR INTERVAL TWO FEET.

FIGURE 4-3

Management Review — Other
Technical Review — Project Manager
Graphic Standards — Lead Professional
QUALITY CONTROL

Developed By PMS,DAP,MJH	Drawn By TMS,LCL,TPB	**PROPOSED DETECTION/COMPLIANCE WELL LOCATION MAP (UPPER AQUIFER)**	Drawing Number 4077.0030 **A10**
Approved By	Date 8-18-95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	**MONTGOMERY WATSON**
Reference			
Revisions			



LEGEND

- MW28 PROPOSED MONITORING WELL LOCATION AND NUMBER
- MW01 UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW10 LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- LW01 LEACHATE HEADWELL LOCATION AND NUMBER
- P01 PIEZOMETER LOCATION AND NUMBER
- SG28 STAFF GAUGE LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC. CONTOUR INTERVAL TWO FEET.

north

0 400

SCALE IN FEET

FIGURE 4-4

Developed By PMS,DAP,MJH Drawn By TMS,LCL,TPB

Approved By Date 8-18-98

Reference

Revisions

PROPOSED DETECTION/COMPLIANCE WELL LOCATION MAP (LOWER AQUIFER)

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 A33

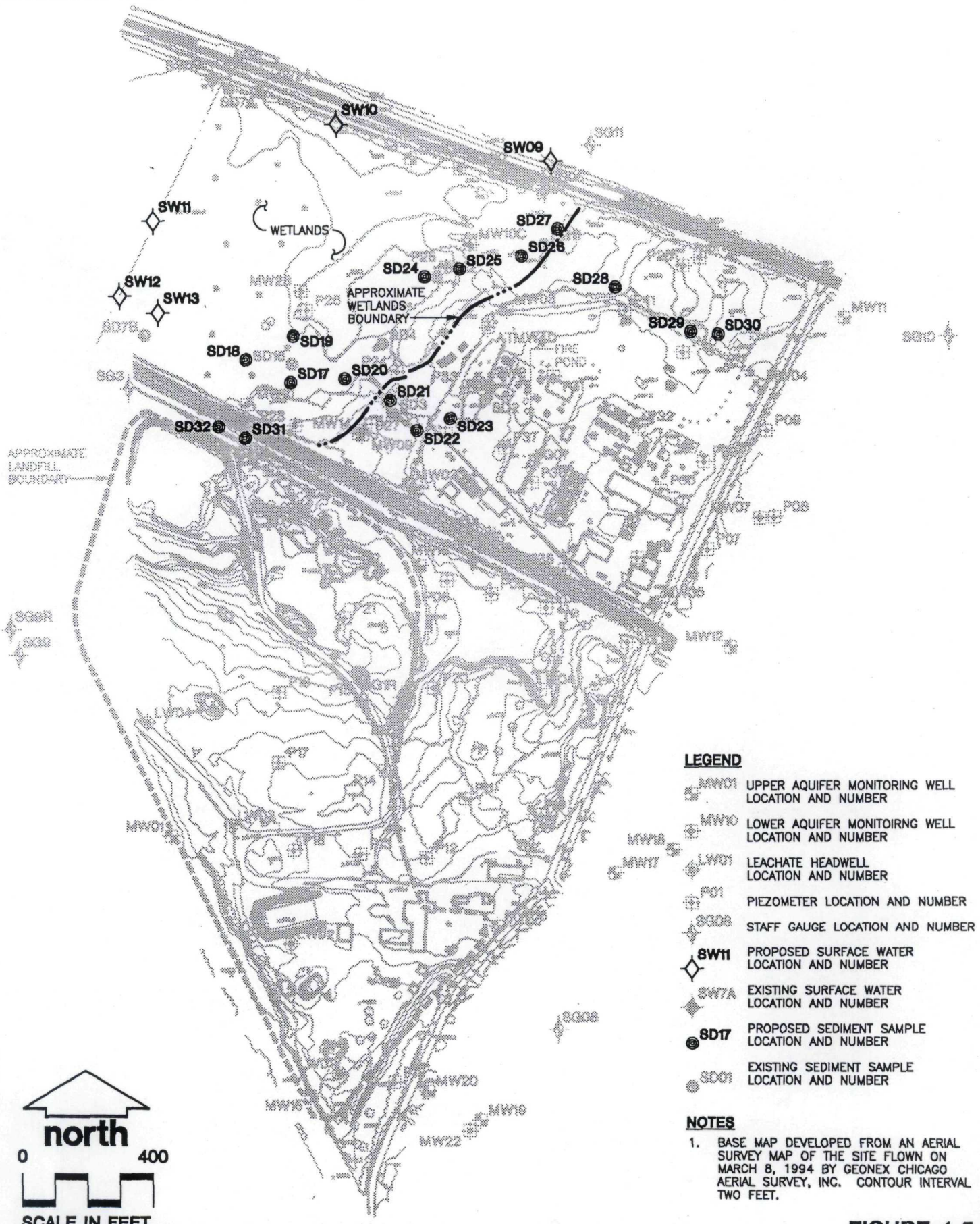
MONTGOMERY WATSON

Management Review — Other

Technical Review — Project Manager

Graphic Standards — Lead Professional

QUALITY CONTROL



LEGEND

- MW01 — UPPER AQUIFER MONITORING WELL LOCATION AND NUMBER
- MW10 — LOWER AQUIFER MONITOIRNG WELL LOCATION AND NUMBER
- LW01 — LEACHATE HEADWELL LOCATION AND NUMBER
- P01 — PIEZOMETER LOCATION AND NUMBER
- SG08 — STAFF GAUGE LOCATION AND NUMBER
- SW11 — PROPOSED SURFACE WATER LOCATION AND NUMBER
- SW7A — EXISTING SURFACE WATER LOCATION AND NUMBER
- SD17 — PROPOSED SEDIMENT SAMPLE LOCATION AND NUMBER
- SD01 — EXISTING SEDIMENT SAMPLE LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC. CONTOUR INTERVAL TWO FEET.

QUALITY CONTROL: Graphic Standards — Lead Professional; Technical Review — Project Manager; Management Review — Other

FIGURE 4-5

Developed By PMS,DAP,MJH	Drawn By TMS,LCL,TPB	**WETLANDS SAMPLE LOCATION MAP**	Drawing Number 4077.0030 **A11**
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	**MONTGOMERY WATSON**
Reference			
Revisions			

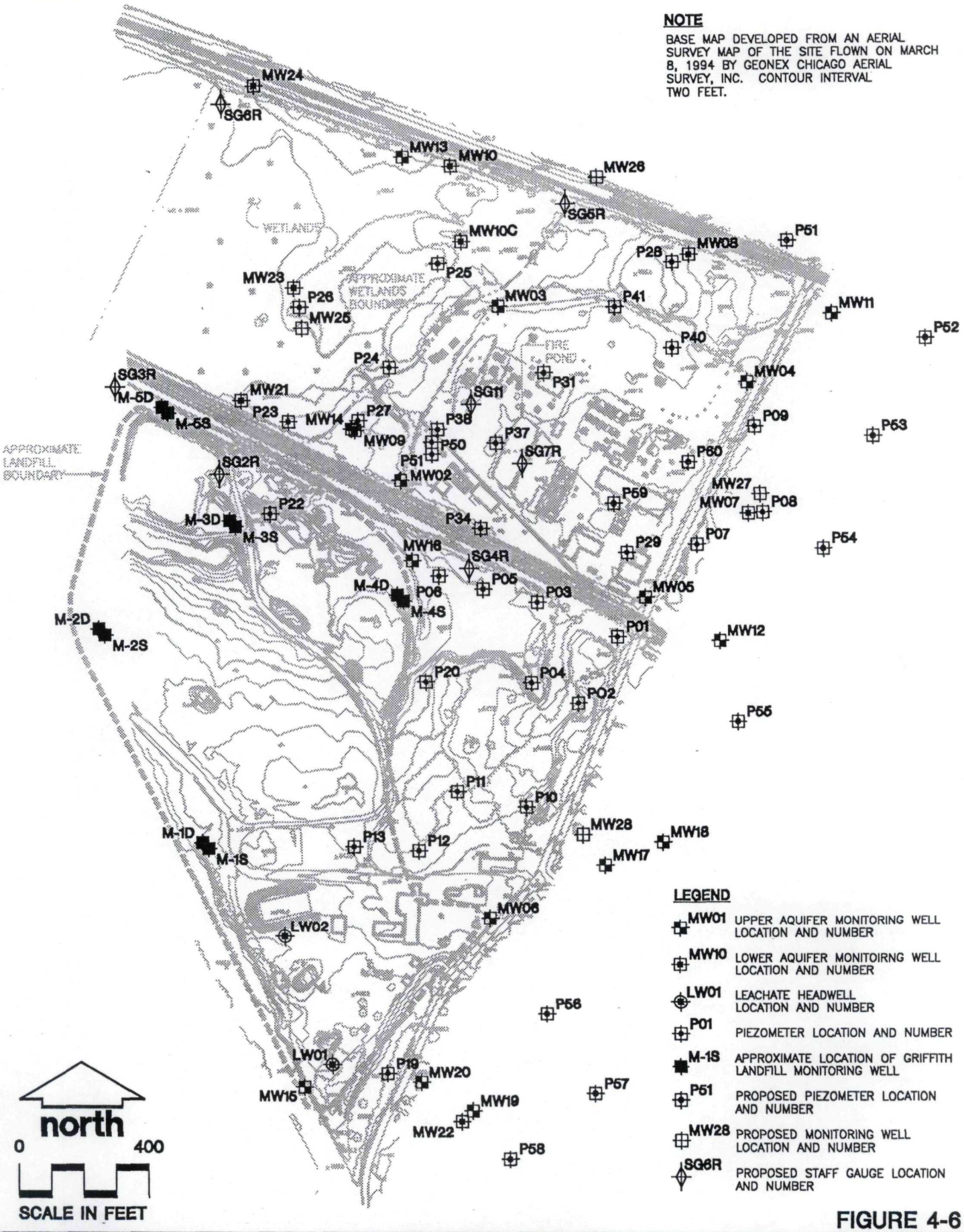
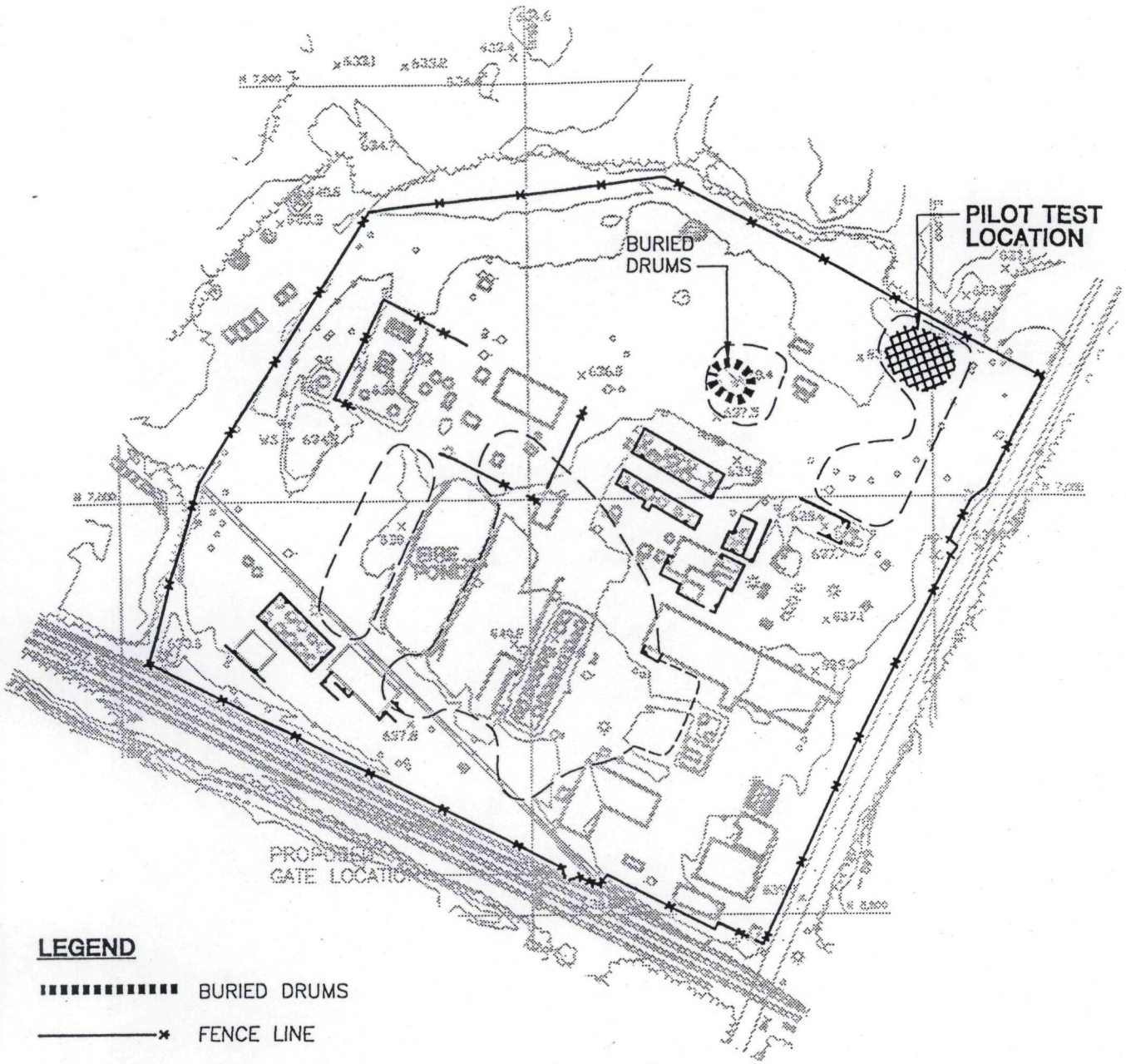


FIGURE 4-6

Management Review: Other
Technical Review: Project Manager
Graphic Standards: Lead Professional
QUALITY CONTROL

Developed By PMS/DAP/MJH	Drawn By TMS,LCL,TPB	**PROPOSED AND EXISTING WATER LEVEL MONITORING POINTS**	Drawing Number 4077.0030 **A47**
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	**MONTGOMERY WATSON**
Reference			
Revisions			



LEGEND

- BURIED DRUMS
- FENCE LINE
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF KNOWN SOIL CONTAMINATION

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2ft.

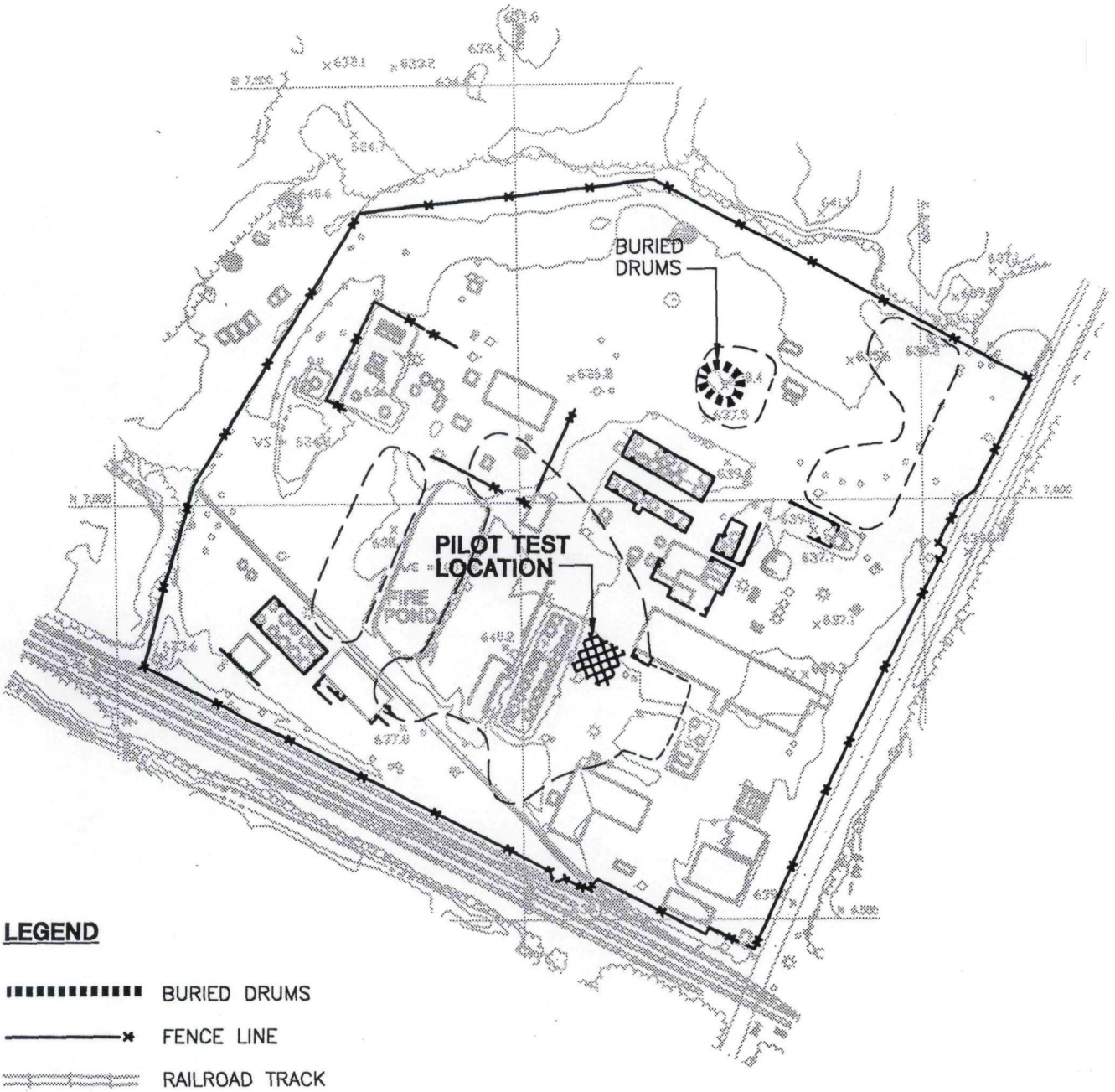
north

0 200 400

SCALE IN FEET

FIGURE 5-1

Developed By PMS/DAP Drawn By TPB Approved By [signature] Date 8/17/95 Reference Revisions	**SOILS ISVE PILOT TEST LOCATION MAP** PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPLSITE GRIFFITH, INDIANA	Drawing Number 4077.0030 A12 MONTGOMERY WATSON



LEGEND

- BURIED DRUMS
- FENCE LINE
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF KNOWN SOIL CONTAMINATION

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2ft.

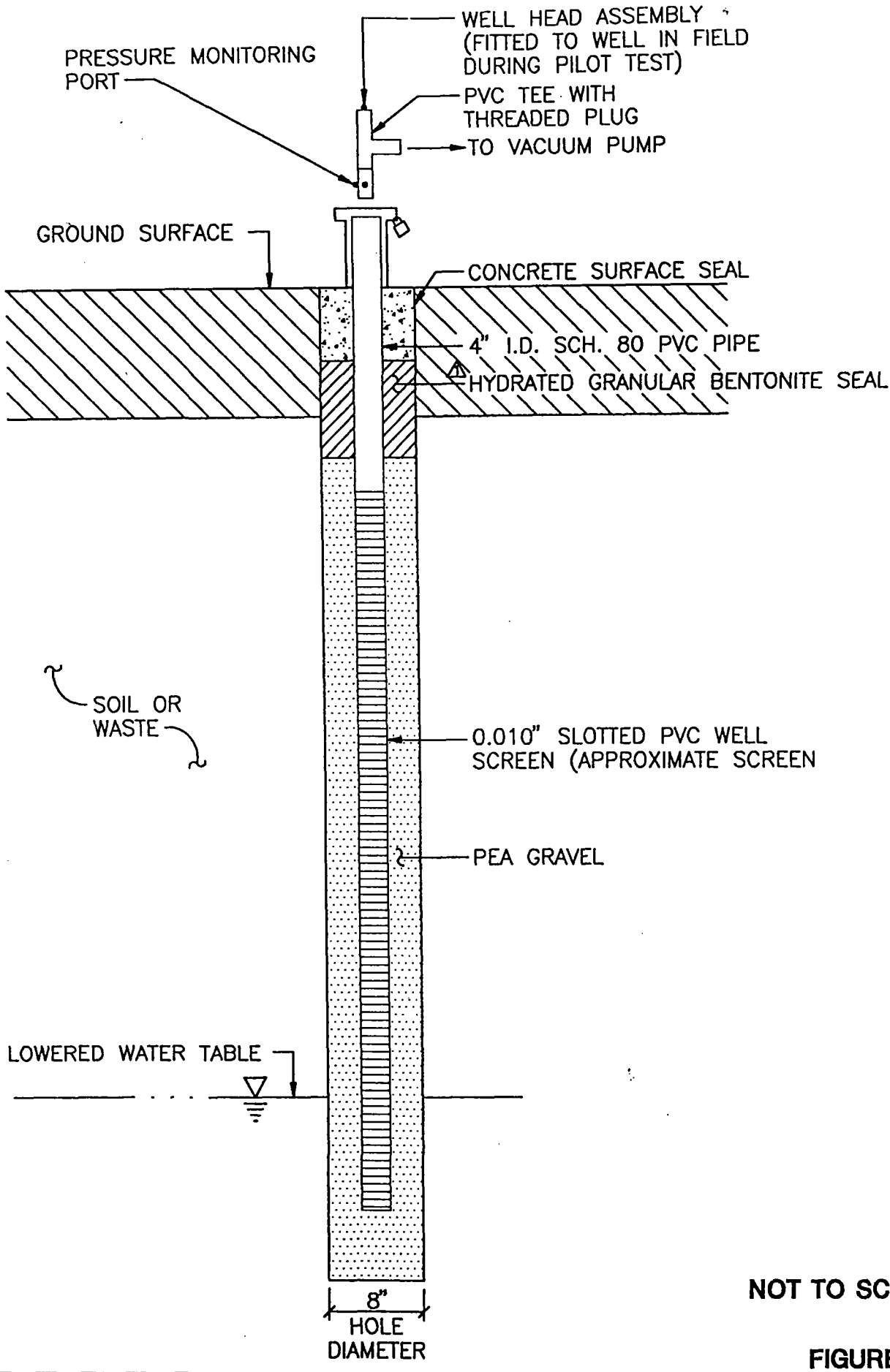
north

0 200 400

SCALE IN FEET

FIGURE 5-2

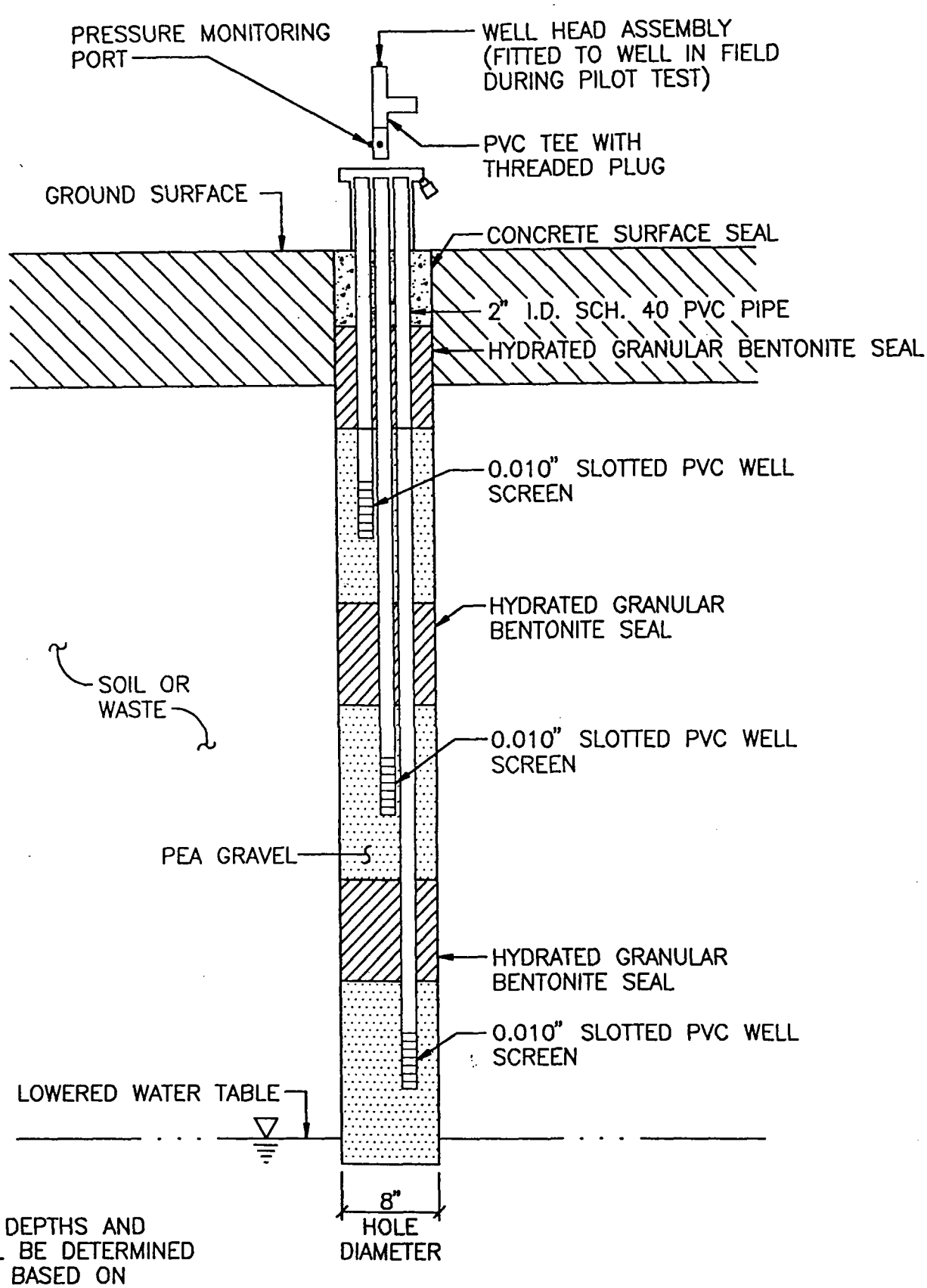
Developed By PMS, DAP	Drawn By TMS, TPB	WASTE ISVE PILOT TEST LOCATION MAP	Drawing Number 4077.0030 A13
Approved By [signature]	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA	MONTGOMERY WATSON
Reference			
Revisions			



NOT TO SCALE

FIGURE 5-3

Developed By MSP	Drawn By JSL	**TYPICAL VAPOR EXTRACTION TEST WELL**	Drawing Number 4077.0030 **A14**
Approved By	Date 8/17/95	PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICES, INC. NPL SITE GRIFFITH, INDIANA	**MONTGOMERY WATSON**
Reference			
Revisions			



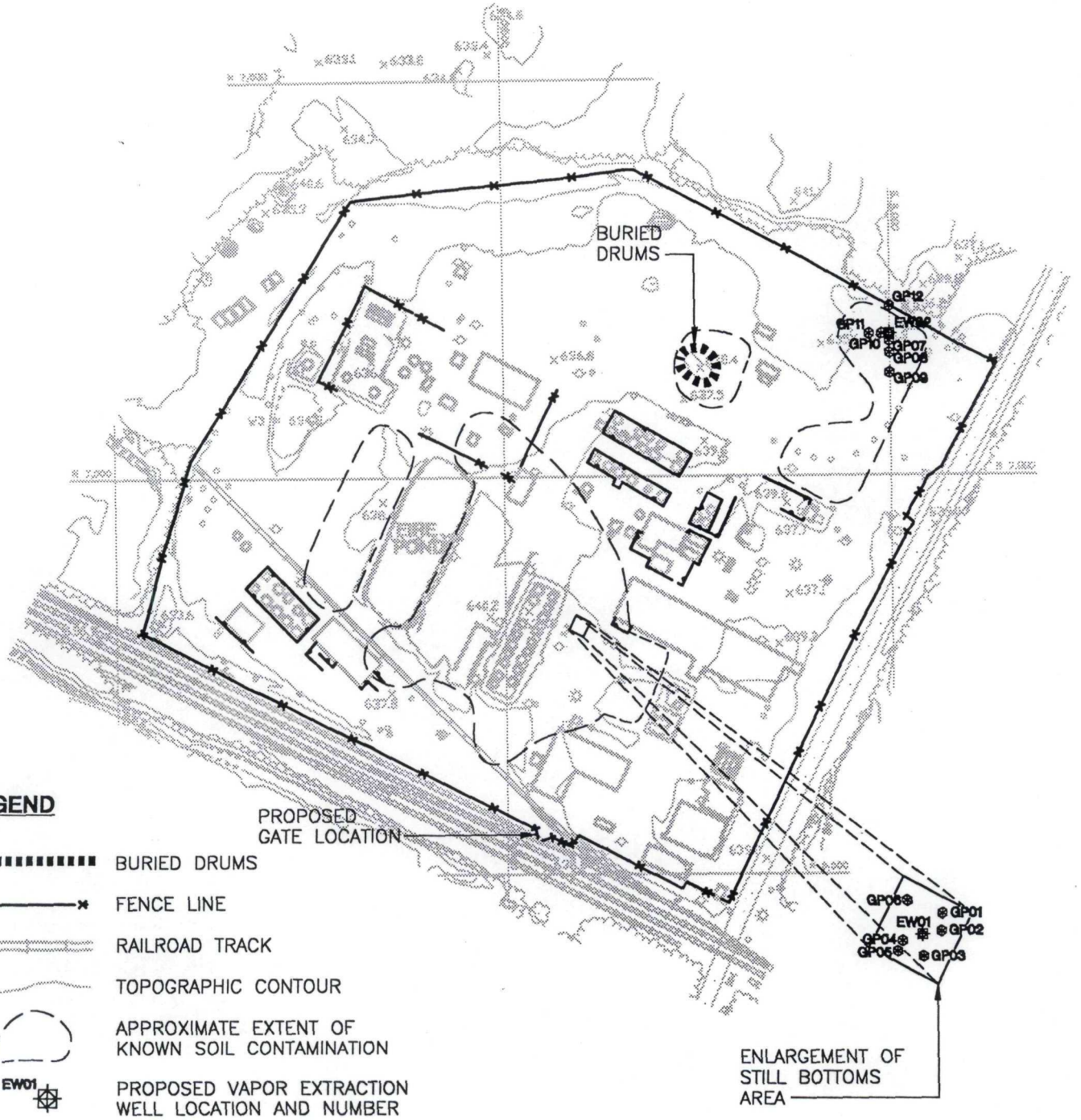
NOTE

INSTALLATION DEPTHS AND LENGTHS WILL BE DETERMINED IN THE FIELD BASED ON GROUNDWATER ELEVATION.

NOT TO SCALE

FIGURE 5-4

Developed By MSR Drawn By JSL Approved By Date 8/17/95 Reference Revisions	**TYPICAL MONITORING PROBE NEST** PRE-DESIGN WORK PLAN AMERICAN CHEMICAL SERVICES, INC. NPL-SITE GRIFFITH, INDIANA	Drawing Number 4077.0030 A15 MONTGOMERY WATSON



LEGEND

- BURIED DRUMS
- FENCE LINE
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF KNOWN SOIL CONTAMINATION
- EW01 — PROPOSED VAPOR EXTRACTION WELL LOCATION AND NUMBER
- GP07 — PROPOSED PRESSURE MONITORING NEST WELL LOCATION AND NUMBER

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.

north

0 200 400

SCALE IN FEET

FIGURE 5-5

Developed By PMS, DAP Drawn By TMS, TPB

Approved By Date 8/17/95

Reference

Revisions

ISVE TEST WELL AND MONITORING PROBE LAYOUT MAP

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number 4077.0030 A16

MONTGOMERY WATSON

Management Review — Other
Technical Review — Project Manager
Graphic Standards — Lead Professional
QUALITY CONTROL

LEGEND

- PROPOSED LOCATION OF SECURITY FENCE
- PROPOSED GATE LOCATION
- RAILROAD TRACK
- TOPOGRAPHIC CONTOUR
- APPROXIMATE EXTENT OF CONTAMINATED SOIL

NOTES

1. BASE MAP DEVELOPED FROM AN AERIAL SURVEY MAP OF THE SITE FLOWN ON MARCH 8, 1994 BY GEONEX CHICAGO AERIAL SURVEY, INC.
2. VERTICAL DATUM IS U.S.G.S. DATUM. CONTOUR INTERVAL IS 2 FEET.

north

0 200 400

SCALE IN FEET

FIGURE 5-6

Developed By

Drawn By

Approved By

Date 8/17/95

Reference

Revisions

MATERIAL HANDLING PILOT TEST LOCATION MAP

PRE-DESIGN WORK PLAN
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
4077.0030 A17

MONTGOMERY WATSON

Management Review: Other
Technical Review: Project Manager
Graphic Standards: Lead Professional
QUALITY CONTROL

APPENDICES

A

P O BOX 190

GRIFFITH, IN 46319

P O BOX 190

GRIFFITH, IN 46319

Revised

Facility Registration Number: 45-00246-IN

Water Withdrawal Report for Year Ending December 31, 1994

WATER WITHDRAWAL RECORD

(1) Units Used in Reporting the Amounts Withdrawn (Check One) ==> Gallons ___ Thousand Gallons X Million Gallons ___

(2) Monthly Report for Ground Water Sources

WELL #	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1	14	25	19	35	46	35	30	52	49	46	22	22	395
2	314	289	265	213	161	90	82	106	104	147	164	286	2221
3	3	0	0	0	3	0	3	0	0	3	0	0	12
4	188	174	155	142	218	164	232	324	237	170	177	136	2317
TOTAL	519	488	439	390	428	289	347	482	390	366	363	444	4945

(3) Monthly

INTAKE#	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
TOTAL													

METHOD OF MEASUREMENT

(4) Are withdrawal amounts based on flow meter readings? Check One ==> Yes ___ No X

If 'No' is checked, please indicate how the withdrawal amounts were determined (Check and complete one of the lines)

X Based on hours operated (Hour meter X Manual record ___)
___ Based on acre inches (# of acres ___ ; # inches ___)
___ Based on Kilowatt hours (Pump power _____ Watts)
___ Based on NPDES data (Consumptive use ___ %)
___ Other (_____)

TOTAL OPERATION TIME

(5) Total number of days operated during the year : 260
Average number of hours operated each day : 24

STATEMENT OF AFFIRMATION

(6) Is your registration information still correct? Check one ==> Yes ___ No X

If 'No' is checked, please indicate the corrections where appropriate.

(7) I hereby affirm under the penalties of perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate, and complete.

GEORGE MURPHY
(Print ~~owner~~ or representative name)

(~~Owner~~ or representative signature) 7/6/95 (date signed)

8/10/95
George Murphy

AUG 14 '95 12:03

SIGNIFICANT WATER WITHDRAWAL FACILITY
FORM # : 21915R

Y.E. 1993

Please complete items (1) through (7)
OWNER OF WATER WITHDRAWAL FACILITY

AMERICAN CHEMICAL SERVICE INC Phone no.: 219-924-4370

P O BOX 190

GRIFFITH, IN 46319

Facility Registration Number: 45-00246-IN

WATER WITHDRAWAL RECORD

(1) Units Used in Reporting the Amounts Withdrawn (Check One) ==>

(2) Monthly Report for Ground Water Sources

WELL #	JAN	FEB	MAR	APR	MAY	JUN	JUL
1	12	29	20	29	36	22	26
2	216	210	198	226	196	112	99
3	2	4	18	0	2	0	8
4	387	198	333	501	911	282	279
TOTAL	617	436	569	751	695	416	349

(3) Monthly Report for Surface Water Sources

INTAKE#	JAN	FEB	MAR	APR	MAY	JUN	JUL
TOTAL							

METHOD OF MEASUREMENT

(4) Are withdrawal amounts based on flow meter readings?
Check One ==> Yes ___ No X

If 'No' is checked, please indicate how the withdrawal amounts were determined (Check and complete one of the lines)

X Based on hours operated (Hour meter X Manual record ___)
___ Based on acre inches (# of acres ___, # inches ___)
___ Based on Kilowatt hours (Pump power _____ Watts)
___ Based on NPDES data (Consumptive use ___ %)
___ Other (_____)

TOTAL OPERATION TIME

(5) Total number of days operated during the year : 240
Average number of hours operated each day : 24

SEND TO : INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
402 WEST WASHINGTON ST., ROOM W264
INDIANAPOLIS, INDIANA 46204
TELEPHONE (317) 232 1116

Contact: MURPHY, JOHN
P O BOX 190

Phone no.: 219-924-4370

GRIFFITH, IN 46319

Water Withdrawal Report for Year Ending December 31, 1993

Gallons ____ Thousand Gallons X Million Gallons ____

	AUG	SEP	OCT	NOV	DEC	TOTAL
	32	26	36	20	36	316
	102	108	212	200	270	2,144
	0	2	0	0	0	28
	345	321	444	309	192	4,002
	479	457	692	529	500	6,490

	AUG	SEP	OCT	NOV	DEC	TOTAL

STATEMENT OF AFFIRMATION

X (6) Is your registration information still correct?
Check one ==> Yes X No ___
If 'No' is checked, please indicate the corrections where appropriate.

(7) I hereby affirm under the penalties of perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate, and complete.

John Murphy
(Print ~~owner or~~ representative name)

John Murphy
(~~Owner or~~ representative signature) 1/5/94 (date signed)

ANNUAL WATER USE REPORT FORM FOR A
SIGNIFICANT WATER WITHDRAWAL FACILITY
FORM # : 21915R

Y. E. 1992

* Please complete items (1) through (7)

OWNER OF WATER WITHDRAWAL FACIL

AMERICAN CHEMICAL SERVICE INC Phone No.: 219-924-4370 Contact: MURPI
P O I

P O BOX 190
GRIFFITH IN 46319 GRIF

Facility Registration Number :45-00246-IN Water W

WATER WITHDRAWAL RECORD

(1) Units Used in Reporting the Amounts Withdrawn (Check one) ==> Gallons

(2) Monthly Report for Ground Water Sources

WELL #	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY
1	18	18	18	32	54	42	42
2	904	238	190	216	124	97	98
3	28	0	2	8	0	2	4
4	546	402	327	408	399	435	483
TOTAL	996	658	587	664	577	576	627

(3) Monthly Report for Surface Water Sources

If any surface water intakes have been installed, please report the amoun

INTAKE#	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY

METHOD OF MEASUREMENT

(4) Are withdrawal amounts based on flow meter readings?
Check one --> Yes ___ No X
If "No" is checked, please indicate how the withdrawal amounts were determined (Check and complete one of the lines)
X Based on hours operated (Hour meter X Manual record ___)
___ Based on acre inches (# of acres ____, # of inches ____)
___ Based on Kilowatt hours (Pump power _____ Watts)
___ Based on NPDES data (Consumptive use _____ %)
___ Other (_____)

TOTAL OPERATION TIME

(5) Total number of days operated during the year : 260
Average number of hours operated each day : 24

STAT

(6) Is y

If "
appr

(7) I he
info
know

(Print

(Owner

SEND TO : INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
402 W. WASHINGTON ST., ROOM W264
INDIANAPOLIS, INDIANA 46204
TELEPHONE (317) 232-1116

FACILITY

t: MURPHY, JOHN Phone No. : 219-924-4370
P O BOX 190

GRIFFITH IN 46319

Water Withdrawal Report for Year Ending December 31, 1992

CORD

Gallons ___ Thousand Gallons X Million Gallons ___

ULY	AUGUST	SEPT.	OCTOBER	NOVEMBER	DECEMBER	TOTAL
42	44	30	46	10	22	376
98	110	114	274	174	278	2,317
4	2	0	12	0	4	62
483	471	396	531	252	297	4,947
627	627	540	863	436	601	7,702

e amount of water withdrawn in the space provided :

ULY	AUGUST	SEPT.	OCTOBER	NOVEMBER	DECEMBER	TOTAL

-- STATEMENT OF AFFIRMATION

6) Is your registration information still correct?
Check one --> Yes X No ___
If "No" is checked, please indicate the corrections where appropriate.

7) I hereby affirm under the penalties of perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate, and complete.

JOHN MURPHY
(Print ~~owner or~~ representative name)

(~~Owner or~~ representative signature) 3/12/93
(Date Signed)

ANNUAL WATER USE REPORT FORM FOR A
SIGNIFICANT WATER WITHDRAWAL FACILITY
FORM # : 21915R

YE. 1991

* PLEASE COMPLETE ITEMS (1) THROUGH (7).

********** OWNER OF WATER WITHDRAWAL F

* AMERICAN CHEMICAL SERVICE INC PHONE NO.:(219)924-4370 CONTACT: MURPHY
* P O BOX 190 P O BO
* GRIFFITH, IN 46319 GRIFFI

* FACILITY REGISTRATION NUMBER ==> 45-00246-IN WATER

********** WATER WITHDRAWAL RECOR

* (1) UNITS USED IN REPORTING THE AMOUNTS WITHDRAWN (CHECK ONE) ==> GALLONS

* (2) MONTHLY REPORT FOR GROUND WATER SOURCES

WELL #	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY
1	16,000	20,000	36,000	66,000	32,000	64,000	74,000
2	242,000	216,000	260,000	198,000	140,000	132,000	108,000
3	—0—	16,000	—0—	2,000	—0—	—0—	—0—
4	258,000	176,000	420,000	531,000	318,000	525,000	324,000
TOTAL	516,000	428,000	716,000	797,000	490,000	723,000	506,000

* (3) MONTHLY REPORT FOR SURFACE WATER SOURCES

* IF ANY SURFACE WATER INTAKES HAVE BEEN INSTALLED,PLEASE REPORT THE AMOUNT

INTAKE #	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY

********** METHOD OF MEASUREMENT **********

* (4) ARE WITHDRAWAL AMOUNTS BASED ON FLOW METER READINGS?
(CHECK ONE) ===> YES ___ NO X
IF "NO" IS CHECKED, PLEASE INDICATE HOW THE WITHDRAWAL AMOUNTS WERE DETERMINED (CHECK AND COMPLETE ONE OF THE LINES)
X BASED ON HOURS OPERATED (HOUR METER X MANUAL RECORD __)
___ BASED ON ACRE INCHES (# OF ACRES _____, # OF INCHES ____)
___ BASED ON KILOWATT HOURS (PUMP POWER: _____ WATTS)
___ BASED ON NPDES DATA (CONSUMPTIVE USE : ___ %)
___ OTHER (_____)

* (6) IS Y
IF
APPR

* (7) I HE
INFO
KNOW
Jud
___
(PRINT
_____
(OWNER

********** TOTAL OPERATION TIME **********

* (5) TOTAL NUMBER OF DAYS OPERATED DURING THE YEAR : 260
AVERAGE NUMBER OF HOURS OPERATED EACH DAY : 24

SEND TO : INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
402 W. WASHINGTON STREET, ROOM W264
INDIANAPOLIS, INDIANA 46204
TELEPHONE (317) 232-1116

ITHDRAWAL FACILITY
ICT: MURPHY, JOHN PHONE NO. : (219)924-4370
P O BOX 190
GRIFFITH, IN 46319

WATER WITHDRAWAL REPORT FOR YEAR ENDING DECEMBER 31, 1991

AWAL RECORD
=> GALLONS X THOUSAND GALLONS ___ MILLION GALLONS ___

JULY	AUGUSI	SEPI.	OCIOBER	NOVEMBER	DECEMBER	IOIAL
79,000	106,000	122,000	116,000	30,000	16,000	708,000
108,000	136,000	114,000	252,000	252,000	250,000	2,272,000
— 0 —	2,000	— 0 —	26,000	26,000	— 0 —	74,000
324,000	224,000	441,000	252,000	152,000	219,000	1,205,000
506,000	468,000	677,000	518,000	473,000	515,000	1,209,000

THE AMOUNT OF WATER WITHDRAWN IN THE SPACE PROVIDED :

JULY	AUGUSI	SEPI.	OCIOBER	NOVEMBER	DECEMBER	IOIAL

STATEMENT OF AFFIRMATION

(6) IS YOUR REGISTRATION INFORMATION STILL CORRECT?
(CHECK ONE) ===> YES X NO ___
IF "NO" IS CHECKED, PLEASE INDICATE THE CORRECTIONS WHERE APPROPRIATE.

(7) I HEREBY AFFIRM UNDER THE PENALTIES OF PERJURY, THAT THE INFORMATION SUBMITTED HEREWITH IS TO THE BEST OF MY KNOWLEDGE AND BELIEF, TRUE, ACCURATE, AND COMPLETE.

Jean Murphy Vice President American Chemical Services, Inc.
(PRINT OWNER OR REPRESENTATIVE NAME)

Jean Murphy 3/10/92
(OWNER OR REPRESENTATIVE SIGNATURE) (DATE)

ANNUAL WATER USE REPORT FORM FOR A
SIGNIFICANT WATER WITHDRAWAL FACILITY
FORM # : 21915R

Y.E. 1990

* PLEASE COMPLETE ITEMS (1) THROUGH (7).

********** OWNER OF WATER W
* AMERICAN CHEMICAL SERVICE INC PHONE NO.:(219)924-4370 CONT
* P O BOX 190
* GRIFFITH, IN 46319
* ----------
* FACILITY REGISTRATION NUMBER ==> 45-00246-IN
****

********** WATER WITHDR
* (1) UNITS USED IN REPORTING THE AMOUNTS WITHDRAWN (CHECK ONE) =
*
* (2) MONTHLY REPORT FOR GROUND WATER SOURCES
* ==========

WELL #	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
1	26,000	980,000	68,000	184,000	64,000	24,000
2	158,000	190,000	202,000	174,000	166,000	78,000
3	2,000	-0-	6,000	4,000	-0-	-0-
4	432,000	223,000	240,000	660,000	468,000	324,000
TOTAL	608,000	1,393,000	1,116,000	1,022,000	698,000	426,000

*
* (3) MONTHLY REPORT FOR SURFACE WATER SOURCES
* ==========
* IF ANY SURFACE WATER INTAKES HAVE BEEN INSTALLED, PLEASE REPORT
* INTAKE # JANUARY FEBRUARY MARCH APRIL MAY JUNE
****

********** METHOD OF MEASUREMENT **********
* (4) ARE WITHDRAWAL AMOUNTS BASED ON FLOW METER READINGS?
* (CHECK ONE) ===> YES ___ NO X
* IF "NO" IS CHECKED, PLEASE INDICATE HOW THE WITHDRAWAL
* AMOUNTS WERE DETERMINED (CHECK AND COMPLETE ONE OF THE LINES)
* X BASED ON HOURS OPERATED (HOUR METER X MANUAL RECORD __)
* ___ BASED ON ACRE INCHES (# OF ACRES _____, # OF INCHES ____)
* ___ BASED ON KILLOWATT HOURS (PUMP POWER: _____ WATTS)
* ___ BASED ON NPDES DATA (CONSUMPTIVE USE : ___ %)
* ___ OTHER (_____)
****
********** TOTAL OPERATION TIME **********
* (5) TOTAL NUMBER OF DAYS OPERATED DURING THE YEAR : 260
* AVERAGE NUMBER OF HOURS OPERATED EACH DAY : 24
****

AUG 14 '95 12:13

SEND TO : INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
2475 DIRECTORS ROW
INDIANAPOLIS, INDIANA 46241
TELEPHONE (317) 232-1106

R WITHDRAWAL FACILITY
ONTACT: MURPHY, JOHN PHONE NO. : (219)924-4370
P O BOX 190
GRIFFITH, IN 46319

WATER WITHDRAWAL REPORT FOR YEAR ENDING DECEMBER 31, 1990

THDRAWAL RECORD
E) ==> GALLONS X THOUSAND GALLONS ___ MILLION GALLONS ___

E__	__JULY__	_AUGUSI_	__SEPI._	OCIOBER_	NOVEMBER	DECEMBER	__IOIAL__
00	34,000	24,000	30,000	30,000	44,000	38,000	4036,000
00	132,000	108,000	96,000	142,000	176,000	218,000	4,900,000
—	6,000	4,000	2,000	10,000	—0—	22,000	56,000
000	402,000	330,000	372,000	390,000	354,000	222,000	5,512,000
---	---	---	---	---	---	---	---
000	574,000	466,000	500,000	572,000	574,000	560,000	8,509,000

ORT THE AMOUNT OF WATER WITHDRAWN IN THE SPACE PROVIDED :

E__	__JULY__	_AUGUSI_	__SEPI._	OCIOBER_	NOVEMBER	DECEMBER	__IOIAL__
---	---	---	---	---	---	---	---

STATEMENT OF AFFIRMATION

(6) IS YOUR REGISTRATION INFORMATION STILL CORRECT?
(CHECK ONE) ==> YES X NO ___
IF "NO" IS CHECKED, PLEASE INDICATE THE CORRECTIONS WHERE
S) APPROPRIATE.

(7) I HEREBY AFFIRM UNDER THE PENALTIES OF PERJURY, THAT THE INFORMATION SUBMITTED HEREWITH IS TO THE BEST OF MY KNOWLEDGE AND BELIEF, TRUE, ACCURATE, AND COMPLETE.

John Murphy Vice President American Chemical Service, Inc.
(PRINT OWNER OR REPRESENTATIVE NAME)

(OWNER OR REPRESENTATIVE SIGNATURE) 3/1/91 (DATE)

ANNUAL WATER USE REPORT FORM FOR A
SIGNIFICANT WATER WITHDRAWAL FACILITY
FORM # : 21915R

Y.E. 1989

********** OWNER OF WATER WITHDRAW
* AMERICAN CHEMICAL SERVICE INC PHONE NO. : (219)924-4370 MU
* P O BOX 190 P
* GRIFFITH, IN 46319 GR
* ----------
* FACILITY REGISTRATION NUMBER ==> 45-00246-IN WA
****

********** WATER WITHDRAWAL R
* UNITS USED IN REPORTING THE AMOUNTS WITHDRAWN (CHECK ONE) ==> GALLONS
*
* MONTHLY REPORT FOR GROUND WATER SOURCES
* ==========

WELL #	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY
1	9990	8880	22,200	57,060	72,150	25,530	167,6
2	265,270	111,000	104,340	83,250	66,600	52,170	49,9
3	630,000	642,000	537,000	667,500	411,000	489,500	417,0
4	108,780	195,360	324,120	317,460	235,320	152,620	277,5
TOTAL	1,034,040	957,240	987,660	1,119,270	785,070	719,820	912,06

*
* MONTHLY REPORT FOR SURFACE WATER SOURCES
* ==========
* IF ANY SURFACE WATER INTAKES HAVE BEEN INSTALLED, PLEASE REPORT THE AM

INTAKE #	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY

****

********** MEASUREMENT METHOD AND
* ARE WITHDRAWAL AMOUNTS BASED ON METERED ES
* READINGS? (CHECK ONE) ==> YES ___ NO X **
* IF "NO" IS CHECKED, HOW WERE THE REPORTED IS
* WITHDRAWAL AMOUNTS DETERMINED? (EXPLAIN BELOW)
* IF
* Time of Pump Operation Method OU
*
* ---------- **
* I
* ---------- TH
* MY
* ---------- --
* OW
* ----------
****

SEND TO : INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
2475 DIRECTORS ROW
INDIANAPOLIS, INDIANA 46241
TELEPHONE (317) 232-1106

RAWAL FACILITY
MURPHY, JOHN PHONE NO. : (219)924-4370
P O BOX 190
GRIFFITH, IN 46319

WATER WITHDRAWAL REPORT FOR YEAR ENDING DECEMBER 31, 1989

L RECORD
ONS X MILLION GALLONS ___ OTHER (SPECIFY) _____

ULY	AUGUSI	SEPI.	OCIOBER	NOVEMBER	DECEMBER	IOIAL
67,610	146,000	89,000	104,000	58,000	40,000	809,420
2,950	128,000	86,000	122,000	150,000	302,000	1,540,582
17,000	—0—	—0—	4,000	7,000	2,000	3,803,000
77,500	504,000	564,000	630,000	462,000	765,000	4,571,160
3,060	228,000	739,000	860,000	672,000	1,109,000	10,923,160

AMOUNT OF WATER WITHDRAWN IN THE SPACE PROVIDED :

ULY	AUGUSI	SEPI.	OCIOBER	NOVEMBER	DECEMBER	IOIAL

AND SIGNATURE

ESTIMATED NUMBER OF DAYS IN OPERATION DURING YEAR : 260

IS THE INFORMATION CONTAINED IN ABOVE PAGES STILL CORRECT?
(CHECK ONE) ==> YES X NO ___
IF "NO" IS CHECKED, PLEASE INDICATE THE CORRECTIONS ABOVE OUTDATED INFORMATION.

STATEMENT OF AFFIRMATION

I HEREBY SWEAR OR AFFIRM UNDER THE PENALTIES OF PERJURY, THAT THE INFORMATION SUBMITTED HEREWITH IS TO THE BEST OF MY KNOWLEDGE AND BELIEF, TRUE, ACCURATE, AND COMPLETE.

OWNER OR REPRESENTATIVE SIGNATURE DATE

John Murphy Vice President Research and Common Science, Inc. 3/27/90

ANNUAL WATER USE REPORT FORM FOR A SIGNIFICANT WATER WITHDRAWAL FACILITY

State Form 21915R

Send to: INDIANA DEPARTMENT OF NATURAL RESOURCES
Division of Water
2475 Director's Row
Indianapolis, Indiana 46241
Telephone (317)232-4160

Authority: IC 13-2-6.1-7 requires that the owner of every registered significant water withdrawal facility shall, within three (3) months after the end of each calendar year, make a verified report to the Natural Resources Commission on forms to be provided by the Commission, of the amounts of water withdrawn during that calendar year.

Note: A report form should be completed for each registered water withdrawal facility. Each form should include the registration number of that facility and the year for which the report is due.

PLEASE PRINT OR TYPE.

OWNER OF WATER WITHDRAWAL FACILITY

Ow AMERICAN CHEMICAL SERVICE INC
P O BOX 190
Ma GRIFFITH, IN 46319
Cit
Fa

e number

JOHN MURPHY
P O BOX 190
GRIFFITH, IN 46319

Phone number 219/924-3144

REGISTRATION NO. : 45-00246-IN

YEAR ENDING DECEMBER 31, 1988

December 31, 19

WATER WITHDRAWAL RECORD

Indicate the units used in reporting the amounts withdrawn (check one) ☒ Gallons ☐ Millions of gallons ☐ Other (specify) _____

Source		MONTH JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
GROUNDWATER	Well No. 1	12,210	8,880	22,200	106,560	34,410	96,620	36,630	97,680	129,870	52,170	125,430	21,090	693,750
	Well No. 2	99,900	103,230	88,800	74,370	47,730	58,830	51,060	53,280	53,280	82,140	83,250	132,090	927,960
	Well No. 3	466,200	355,200	497,280	143,190	389,610	592,740	516,150	569,430	560,550	586,080	410,700	517,260	5,604,390
	Well No. 4	91,020	158,730	200,910	320,790	230,880	389,610	199,800	303,030	279,720	245,310	236,430	157,620	2,813,850
	TOTAL	669,330	626,040	809,190	644,910	702,630	1,087,800	803,640	1,023,420	1,023,420	965,700	855,810	828,060	10,039,950
SUBFACE WATER	Intake No.													
	Intake No.													
	Intake No.													
	Intake No.													
	TOTAL													

Are withdrawal amounts based on metered readings ☐ Yes ☒ No

If "No" is checked, how were the reported withdrawal amounts determined? (Attach separate sheet or use the reverse side of this form if necessary).

TIME OF PUMP OPERATION METHOD

Estimated number of days in operation during year 260

Is the information originally supplied on your registration form still correct? ☒ Yes ☐ No
If "No" is checked, please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary information.

STATEMENT OF AFFIRMATION

I hereby swear or affirm under the penalties of perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate and complete.

Owner or authorized representative's signature: John Murphy VICE PRESIDENT ACS

Date: 23 MARCH 1989

ANNUAL WATER USE REPORT FORM FOR A SIGNIFICANT WATER WITHDRAWAL FACILITY

State Form 21915R

Send to: INDIANA DEPARTMENT OF NATURAL RESOURCES
Division of Water
2475 Director's Row
Indianapolis, Indiana 46241
Telephone (317)232-4160

Authority: IC 13-2-6.1-7 requires that the owner of every registered significant water withdrawal facility shall, within three (3) months after the end of each calendar year, make a verified report to the Natural Resources Commission on forms to be provided by the Commission, of the amounts of water withdrawn during that calendar year.

Note: A report form should be completed for each registered water withdrawal facility. Each form should include the registration number of that facility and the year for which the report is due.

PLEASE PRINT OR TYPE.

OWNER OF WATER WITHDRAWAL FACILITY

Owner's name	AMERICAN CHEMICAL SERVICE INC	Contact perso	JOHN MURPHY
Mailing add	P O BOX 190	Mailing addre	P O BOX 190
City, State	GRIFFITH, IN 46319	City, State an	GRIFFITH, IN 46319
Facility reg	REGISTRATION NUMBER : 45-00246-IN	Water withdra	YEAR ENDING DECEMBER 31, 1987

WATER WITHDRAWAL RECORD

Indicate the units used in reporting the amounts withdrawn (check one) ☒ Gallons ☐ Millions of gallons ☐ Other (specify) _____

Source		MONTH JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
GROUNDWATER	Well No. 1	19,980	24,420	66,600	44,400	46,620	48,840	75,480	79,920	88,800	115,440	66,600	119,880	796,980
	Well No. 2	150,960	137,640	115,400	88,800	57,700	48,840	64,380	46,620	53,280	67,700	57,700	93,240	972,260
	Well No. 3	375,000	312,000	249,000	501,000	932,000	162,000	462,000	534,000	657,000	336,000	276,000	450,000	4,746,000
	Well No. 4	202,020	179,820	195,360	137,640	179,820	188,700	173,160	135,420	226,480	190,920	139,860	148,740	2,097,900
	TOTAL	747,960	653,880	626,360	771,840	716,140	448,380	725,020	795,960	1,025,520	700,060	540,160	811,860	8,613,140
SURFACE WATER	Intake No.													
	Intake No.													
	Intake No.													
	Intake No.													
	TOTAL													

Are withdrawal amounts based on metered readings ☐ Yes ☒ No

If "No" is checked, how were the reported withdrawal amounts determined? (Attach separate sheet or use the reverse side of this form if necessary).

TIME OF PUMP OPERATION METHOD

Estimated number of days in operation during year 260

Is the information originally supplied on your registration form still correct? ☒ Yes ☐ No

If "No" is checked, please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary information.

STATEMENT OF AFFIRMATION

I hereby swear or affirm under the penalties of perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate and complete.

Owner or authorized representative's signature: John Murphy VICE PRESIDENT ACS

Date: 22 MARCH 1988

ANNUAL WATER USE REPORT FORM FOR A SIGNIFICANT WATER WITHDRAWAL FACILITY

State Form 21915R

Send to: INDIANA DEPARTMENT OF NATURAL RESOURCES
Division of Water
2475 Director's Row
Indianapolis, Indiana 46241
Telephone (317)232-4160

Authority: IC 13-2-6.1-7 requires that the owner of every registered significant water withdrawal facility shall, within three (3) months after the end of each calendar year, make a verified report to the Natural Resources Commission on forms to be provided by the Commission, of the amounts of water withdrawn during that calendar year.

Note: A report form should be completed for each registered water withdrawal facility. Each form should include the registration number of that facility and the year for which the report is due.

PLEASE PRINT OR TYPE.

OWNER OF WATERWAY

AMERICAN CHEMICAL SERVICE INC
P O BOX 190
GRIFFITH, IN 46319

Phone number

OPERATOR

JOHN MURPHY
P O BOX 190
GRIFFITH, IN 46319

Phone number

REGISTRATION NUMBER : 45-00246-IN

YEAR ENDING DECEMBER 31, 1986

December 31, 19

WATER WITHDRAWAL RECORD

Indicate the units used in reporting the amounts withdrawn (check one) ☒ Gallons ☐ Millions of gallons ☐ Other (specify) _____

	Source	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
		MONTH												
GROUNDWATER	Well No. 1	79920	22200	124320	142080	135420	26640	48840	35520	35520	22200	31080	64360	768,160
GROUNDWATER	Well No. 2	202020	128760	113220	88800	95460	62160	64360	64380	75480	79920	64380	170940	1,209,900
GROUNDWATER	Well No. 3	744000	666000	201000	564000	810000	339000	351000	516000	396000	351000	169000	357000	5,464,000
GROUNDWATER	Well No. 4	137640	95460	230860	266400	313020	190920	333000	124320	166500	190920	155940	186480	2,390,940
	TOTAL	1,163,580	912,420	669,420	1,061,280	1,353,900	618,720	797220	740,220	673,500	644,040	939,860	798760	9,832,940
SURFACE WATER	Intake No.													
SURFACE WATER	Intake No.													
SURFACE WATER	Intake No.													
SURFACE WATER	Intake No.													
	TOTA													

Are withdrawal amounts based on metered readings ☐ Yes ☒ No

If "No" is checked, how were the reported withdrawal amounts determined? (Attach separate sheet or use the reverse side of this form if necessary).

TIME OF PUMP OPERATION METHOD

Estimated number of days in operation during year. 260

Is the information originally supplied on your registration form still correct? ☒ Yes ☐ No

If "No" is checked, please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary information.

STATEMENT OF AUTHORIZATION

I hereby swear or affirm under the penalties of perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate and complete.

Owner or authorized representative's signature: John Murphy Vice President

Date: 30 MARCH 87

ANNUAL WATER USE REPORT FORM FOR A SIGNIFICANT WATER WITHDRAWAL FACILITY

State Form 21915

Send to: INDIANA DEPARTMENT OF NATURAL RESOURCES
Division of Water
2475 Director's Row
Indianapolis, Indiana 46241
Telephone (317) 232-4160

Authority: IC 13-2-8.1-7 requires that the owner of every registered significant water withdrawal facility shall, within three (3) months after the end of each calendar year, make a verified report to the Natural Resources Commission on forms to be provided by the Commission, of the amounts of water withdrawn during that calendar year.

Note: A report form should be completed for each registered water withdrawal facility. Each form should include the registration number of that facility and the year for which the report is due.

FOR OFFICE USE ONLY	Record For Year Ending December 31, 19____	County	Basin	Registration No.
	UTM. N	UTM. E	Township / Range / Section	Topographic Map

INSTRUCTIONS: IF ADDITIONAL REPORT FORMS ARE NEEDED, PLEASE CONTACT THE DIVISION OF WATER AT THE ADDRESS MENTIONED ABOVE.

PLEASE PRINT OR TYPE.

OWNER OF WATER WITHDRAWAL FACILITY

Owner's Name	Phone No.	Contact Person (if other than owner)	Phone No.
American Chemical Service Inc.	219/924-4370		
Mailing Address		**Mailing Address**	
P.O. Box 190			
City, State and Zip		**City, State and Zip**	
Griffith, IN 46319			
Facility Registration No.		**Water Withdrawal Report for Year Ending**	
45-00246-IN		December 31, 19 85	

WATER WITHDRAWAL RECORD

Indicate the units used in reporting the amounts withdrawn (check one) ☒ Gallons ☐ Thousands of Gallons ☐ Millions of Gallons ☐ Other (specify) _____

	Source	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
GROUNDWATER	Well No. 1	82140	119880	255300	79920	130940	122100	52920	217560	53500	190920	55500	77700	1,485,180
	Well No. 2	84360	93240	137640	117660	106560	62160	66600	111000	89360	97680	115440	153400	1,232,100
	Well No. 3	753000	669000	720000	690000	900000	792000	927000	930000	678000	732000	618000	492000	8,901,000
	Well No. 4	157620	135420	235320	259740	202020	99900	217560	195260	237540	173160	195360	179160	2,282,160
	TOTAL	1,077,120	1,017,540	1,348,260	1,147,320	1,339,520	1,076,160	1,268,880	1,453,920	1,055,400	1,193,760	984,300	898260	13,900,440
SURFACE WATER	Intake No.													
	Intake No.													
	Intake No.													
	Intake No.													
	TOTAL													

Are withdrawal amounts based on metered readings? ☐ Yes ☒ No

If "No" is checked, how were the reported withdrawal amounts determined? (Attach separate sheet or use the reverse side of this form, if necessary)

Time of Pump Operation Method

Estimated No. of Days in Operation During Year 260

Is the information originally supplied on your registration form still correct? ☒ Yes ☐ No

If "No" is checked, please attach a separate sheet indicating the nature of the change. If needed a new registration form will be forwarded to you in order that you may provide this office with the necessary revisions.

STATEMENT OF AFFIRMATION

I hereby swear or affirm under the penalties for perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate and complete.

Owner or Authorized Representative's Signature _____ Date 1-__-__